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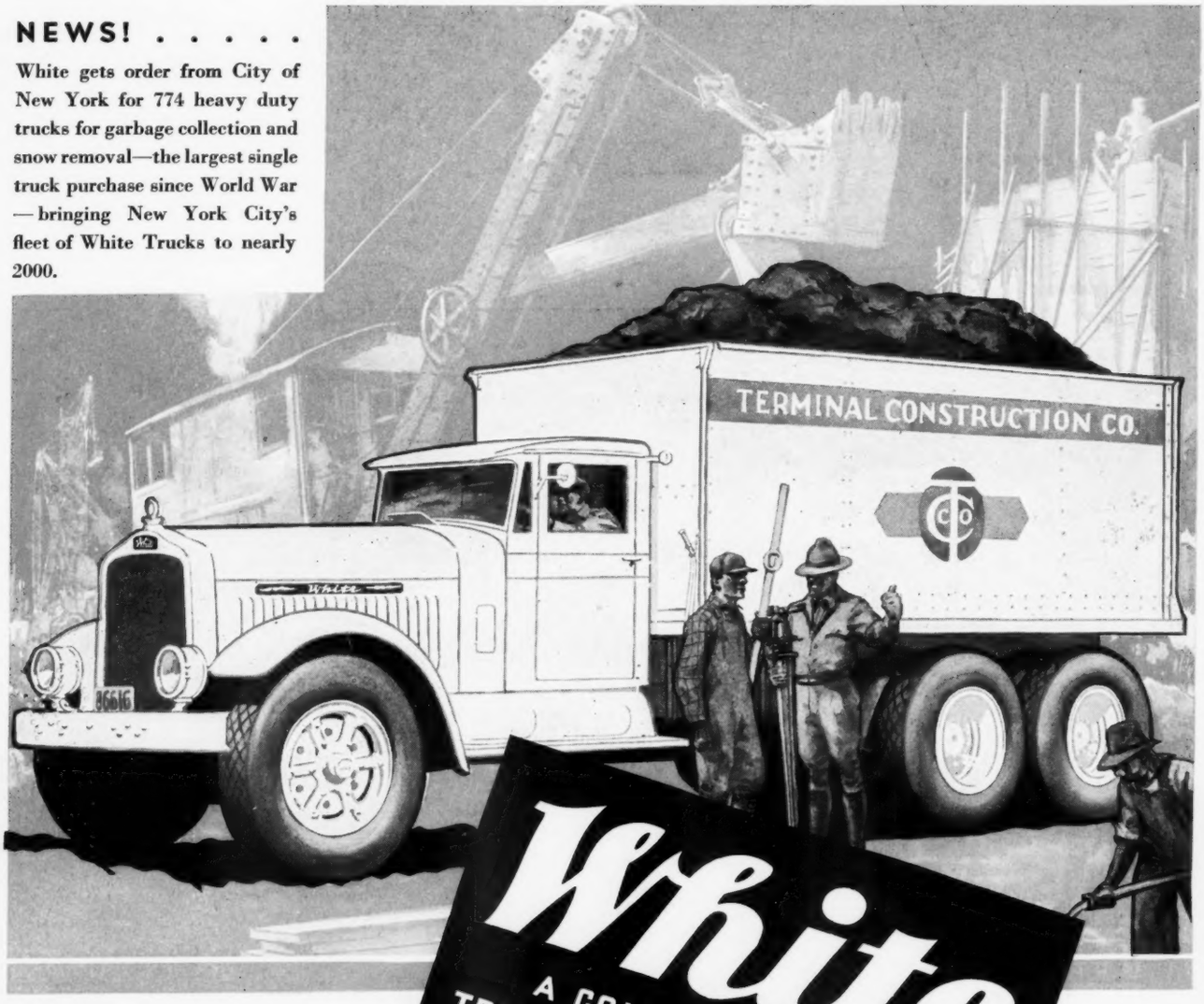

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Cleveland

SEE THE WHITE TRUCK EXHIBIT AT THE ROAD SHOW

VOL. 63 No. 1
Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879,
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JANUARY, 1932

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JANUARY, 1932

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WHEN you go to the road show at Detroit this month, plan a day's stop-over in Cleveland. At the Cletrac plant, OPEN HOUSE has been planned for all of Cletrac's many friends of the A. R. B. A. who can arrange to come — and we promise a day chock full of interest and hospitality. Please consider this your invitation to inspect one of the world's most modern tractor plants and be its guest for a day.

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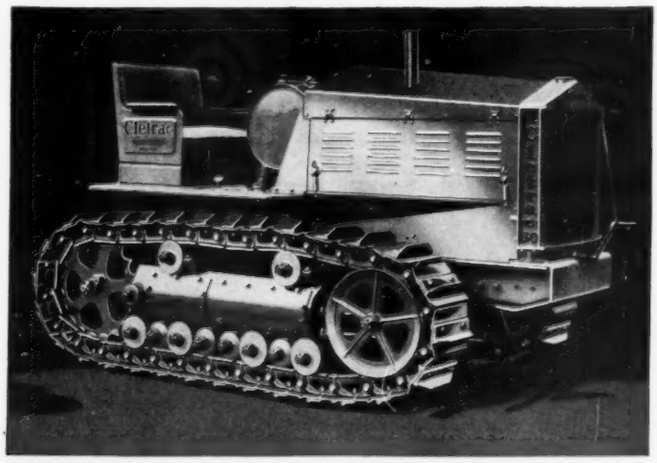

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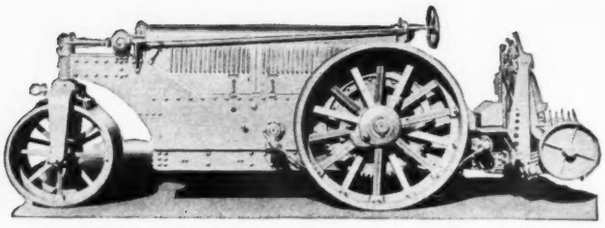

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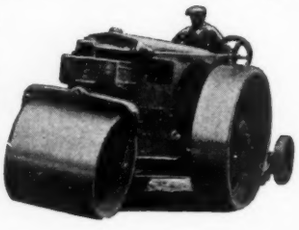

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With Our Authors

D. Y. BATE, whose likeness is presented herewith through the cooperation of his daughter, is now an engineer of the Department of Public Works of Los Angeles, Calif., where he has specialized in the design of difficult, curvilinear and sidehill streets. His articles in PUBLIC WORKS during the past year have presented valuable data on curve superelevation, and on width at curves. In forthcoming issues other very practical and valuable articles by Mr. Bate will appear. Mr. Bate is a native of Kentucky. He spent three years at Kentucky State College. Since that time he has had a wide experience, ranging from rodman, chainman and instrumentman on the Southern Railroad, to service with the U. S. Engineers, construction work on the Minidoka Project of the Reclamation Service, service on the battlefields of France, state highway work, and, since 1924, with the city of Los Angeles. We are glad to welcome Mr. Bate to this page, as one of our most valued contributors.

Other Contributors to This Issue

H. BURDETT CLEVELAND, consulting engineer of New York city, presents in this issue his annual review of developments in Water Supply, Sewerage and Refuse Disposal—a most popular feature judging by the requests we receive for extra copies. EARL V. MURRAY, statistician of the Ohio Department of Highways, tells of brick pavement construction in Ohio in 1931. BERNARD E. GRAY of the Asphalt Institute presents new developments in the use of asphalt for road surfacing. WAYT THOMAS, city Engineer of Charlotte, N. C., describes the method used in that city for rejuvenating pavements that are badly worn, but still salvageable. W. E. BARKER presents the accomplishments in concrete paving during the past year. C. A. BINGHAM, city manager of Norwood, Mass., tells of his very practicable and sensible plan of centralized purchasing, which might well be adopted by other cities. W. McK. WHITE describes a low cost road job, and JOS. C. COYLE tells of road construction above the timber line. JOHN SIMPSON continues his digest of legal decisions of interest to engineers and contractors. D. C. BROOKS describes experimental concrete paving work in Kentucky.

B. E. Gray

John Simpson

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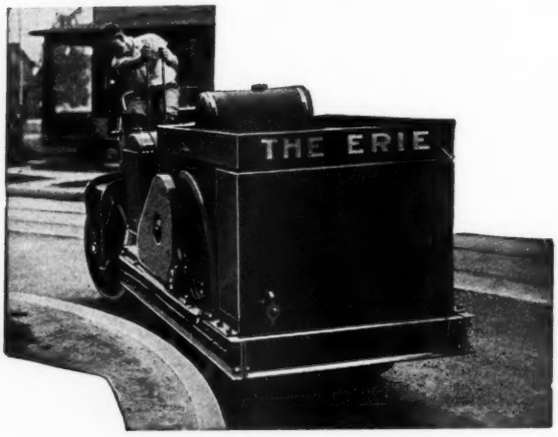

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Greater Safety In Road Pavements

WITH a view to contributing its part toward making the highways of the nation absolutely safe for high-speed motoring and free wheeling, the Asphalt Institute, New York, in a new manual just issued, after several years of research cooperation with the United States Bureau of Public Roads and various state road-building departments, describes in detail methods of constructing two modern low-cost types of skidproof "road-mix" surfaces for country roads, which will revolutionize the construction of highways carrying a traffic volume up to two thousand vehicles per day.

The outstanding features of these "road-mix" types are first, that the gravel or stone and the asphalt are mixed on the roadway, thus utilizing all the available material and eliminating long hauls; second, that the mixture thus obtained is spread and compacted while cold, thus obviating the costly heating of materials; and third, that the granular or fragmentary gravel or stone aggregates, after compaction, form a surface of somewhat open texture, thus affording a good grip by automobile tires at all times. These types of pavement are slightly resilient and the wear on tires has been found to be negligible.

Gravel roads are treated under the designation of "the graded aggregate type," the construction methods for which are fully described in the new manual; while old macadam roads are improved and new surfaces are provided as described in the manual under the title of "the macadam aggregate type." Excessive crowns are everywhere eliminated and all curves are banked.

The improved types have been tried out with satisfaction by the state highway departments of Massachusetts, West Virginia, Indiana, Kentucky, Arizona, California, Colorado, Montana, New Mexico, Oregon, Virginia, Wyoming and Wisconsin. Vermont is trying them out this season. Costs for either type, in different localities, according to the proximity of aggregate materials and labor costs, etc., range from $2,500 to $6,000 per mile, while maintenance averages only about $300 per mile per year thereafter.

Crown Data for Roads and Streets

Crown Data for Roads and Streets. 22 pages; illustrated. Price, $1. Cleveland Formgrader Co., Cleveland, O.

This book has been prepared to give engineers and contractors tabulated data on ordinates for various crowns at 1-foot intervals across the slab, as well as at the quarter point. Ordinates to both circular and parabolic crowns are given to the nearest 64th of an inch.

Operating Swimming Pools

Keeping the Swimming Pool Safe and Sanitary. Illustrated; 24 pages; pocket size. Price 10 cents. The Mathieson Alkali Works, N. Y.

An excellent little booklet devoted to the use of chlorine in swimming pool operation. It discusses routine operation, the maintenance of residual chlorine in the water, and other phases of sanitation, all with reference to the use of HTH (high test hypo).

PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 63 JANUARY, 1932 NO. 1

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Brain Teasers:

Quite a few problems, puzzles and perplexities have combined to make up the holiday mail of the editor of this department. We are not yet ready to announce the winner of the contest outlined in the December issue, because it has been necessary to go through each problem separately to determine whether or not it is possible, or whether the premises on which it is based are true. Every effort will be made to announce the names of the winners in the February issue. In the meantime, here is one to keep our readers in trim.

"Infantry marching in a column 20 miles long. A courier started from the rear of the column, delivered a message to the head of the column, and returned to the rear with the reply. When he reached the rear of the column, the rear was at the point occupied by the head of the column when he started his trip from rear to head. How fast did he travel, how fast did the column travel, and how far did the courier travel."

It is our idea that this is not workable without an additional factor, probably the speed of the column. Assuming this as 2½ miles an hour (in accordance with directions from the Army War College), the problem is not especially difficult. We should be glad to hear from anyone that can work it without the additional assumption of speed of column.

More About Mike & Ike:

Solutions of the Mike & Ike problem continue to roll in from various points. One of them was a mental solution from W. M. Piatt, consulting engineer of Durham, N. C. Well, that's beyond us. We are willing to resign this chair of Mathematical Pastiming in favor of him or anyone else in that class.

1931 and 1932:

As some one has said, 1931 carried a punch in either hand, and a kick in either foot. Yet as it passes into history, we must credit it with giving us a lot of experience, and in training us in fortitude. Let us hope that 1932 will be a little less difficult taskmaster, containing a little more of the milk of human kindness. And PUBLIC WORKS wishes to all the engineering and construction fraternity a Happy and Healthy and Prosperous New Year.

J. T. MORRIS
President
W. A. HARDENBERGH
Vice-Pres. & Asso. Editor
CROXTON MORRIS
Ass't Manager

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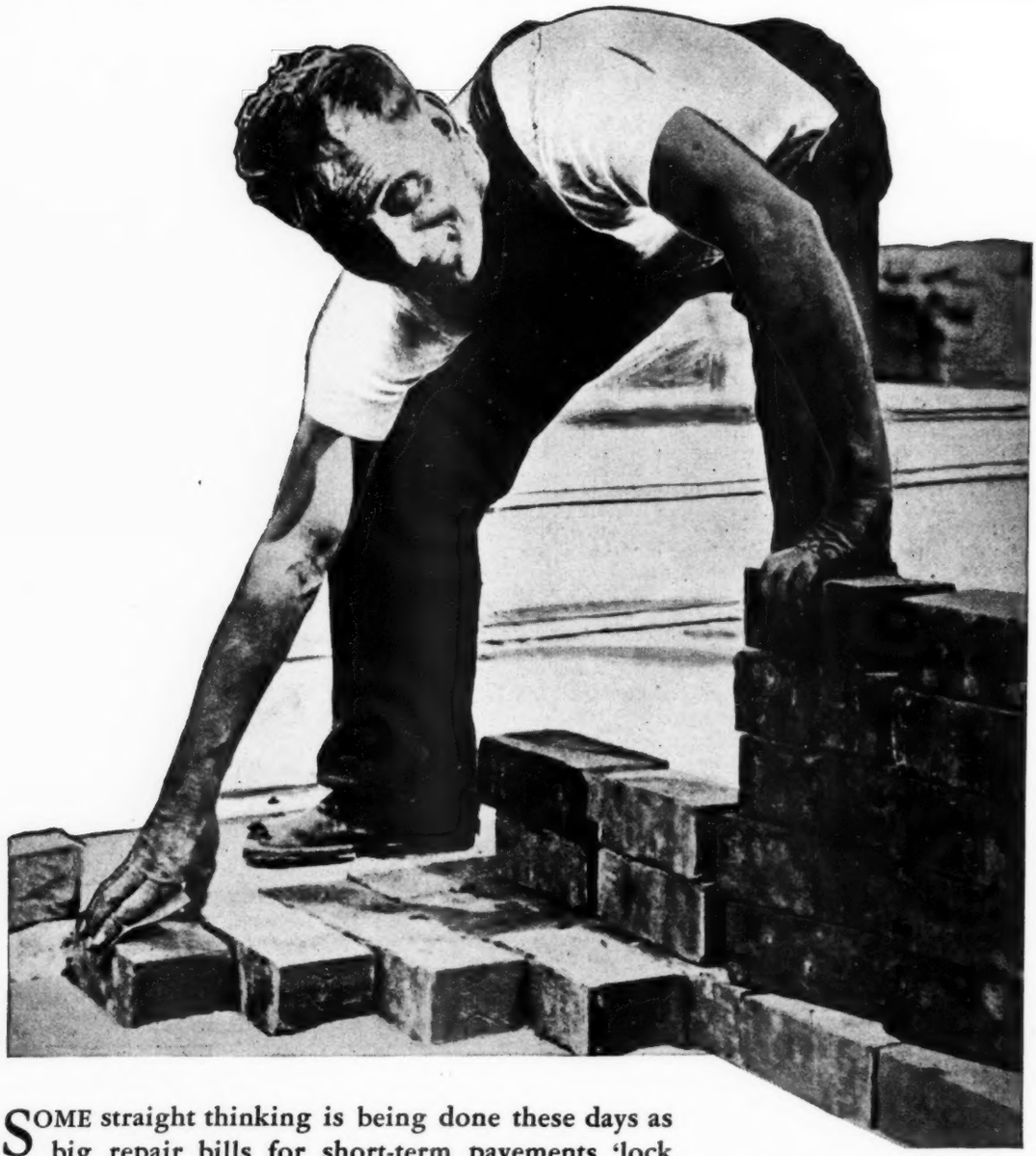
"STRAIGHT" THINKING is being done these days



SOME straight thinking is being done these days as big repair bills for short-term pavements 'lock horns' with undernourished budgets.

Why not act now in *your* community to prevent such recurrences in 1937, or 1942 or 1952!

Resurface and rebuild with brick! Protect new pavements with the weather-proof and traffic-proof armor of vitrified brick. Check your records on brick maintenance as against other types—ask neighboring officials their experience. It is lowest by far—but check up anyway!

2 Important Meetings

Exhibiting at American Roadbuilders' Convention at Detroit, January 11-16, 1932.

★ ★ ★

Annual meeting of National Paving Brick Association February 10-11-12, 1932, Hotel Palmer House, Chicago. The roadbuilding public is invited. Write National Paving Brick Association, 1245 National Press Building, Washington, D. C., for program.

BRICK—the Pavement that Lasts

For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 75

PUBLIC WORKS

CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 63 January, 1932 No. 1

Laying 50-foot brick pavement on U. S. No. 40—27½ miles of super highway between Hebron and Columbus

1931 Brick Pavement Construction in Ohio

By Earl V. Murray,

Statistician, Ohio State Department of Highways

BY the close of 1931, Ohio will have approximately 1529 miles of brick highways on the State System of 11,544 miles, exclusive of streets within the corporate limits of cities. Some of these brick pavements represent the oldest on the system, while others possess the most modern features of design and construction known to the engineering profession.

Pavements in the early days of road building in Ohio were designed to carry horse and buggy traffic and necessarily were of narrow width and light structure. With the sudden development of the automobile, there was thrust upon highway engineers the problem of meeting the increasingly rapid and complex demands of a varied traffic. With this era came that of scientific experiments. Ohio was not unlike many other States in this respect, for no doubt all went through a process of road experiments. Fortunately, Ohio has emerged fairly well, but not entirely free from the "test tube." As research and study have revealed the behavior of road materials under the wide range of sub-soil conditions, climate and traffic, so proportionately have these experiments decreased.

For the production of road building material, Ohio is blessed with geological deposits of the highest quality of gravel, clay, shale, limestone, sandstone, etc. Because of the qualities of its clay and shale, Ohio came to be the country's largest producer of clay products. Since paving brick is a manufactured product of clay or shale, it was only natural that Ohio should lead in the making of paving brick.

The paving brick industry has developed into one of the most important industries in the State. At present there are 27 brick paving plants located in Ohio, two of these being State owned and operated by prisoners from the Ohio State Penitentiary. The combined total production capacity of these plants is 350,000,000 paving brick annually.

The total yardage area of brick pavement on the State system, exclusive of city streets, is approximately 16,675,025 square yards. Annually this yardage is increased, and during the year just closed 99 miles of brick construction was awarded, representing a total of 1,305,554 square yards, and costing $3,912,768.69. A number of these improvements have been completed and opened to traffic, and others are rapidly nearing completion.

Outstanding among the 1931 newly constructed brick pavements, all of which are classed as super highways, are the six miles of 40 to 46-foot width highway in Cuyahoga county near Cleveland, known as the Wooster Pike; the 12-mile section of 40-foot width pavement on the Akron-Canton Road, State Route No. 8; 1½ miles of a 50-foot width pavement on the National Road, U. S. No. 40 through the

eastern portion of Columbus and the village of Bexley; and 8 miles of 20-foot brick pavement on the Zanesville-Caldwell Road referred to as Governor White's emergency relief road.

The most popular designs in Ohio's brick pavement construction have a concrete base composed of 1:7½ mix, and of variable thickness, sometimes reinforced, and a sand cushion averaging ¾" in depth, upon which is laid a 3" to 4" depth wire-cut or repressed lug brick, which is filled with an asphalt filler. Side supports for the brick surface are usually a flush concrete curb built integrally with the base. In some cases of wide suburban pavements, the raised curb of either concrete or sandstone is used.

The subgrade for a concrete base course is carefully prepared by a subgrade machine and rolled with a 3-wheel roller weighing from 3 to 10 tons, the rolling being extended 18" beyond the edge of the proposed concrete base. A templet operating upon the forms ahead of the mixer is used to check the elevation of the subgrade and any variation found is made to conform with the proper cross section, before the concrete is poured.

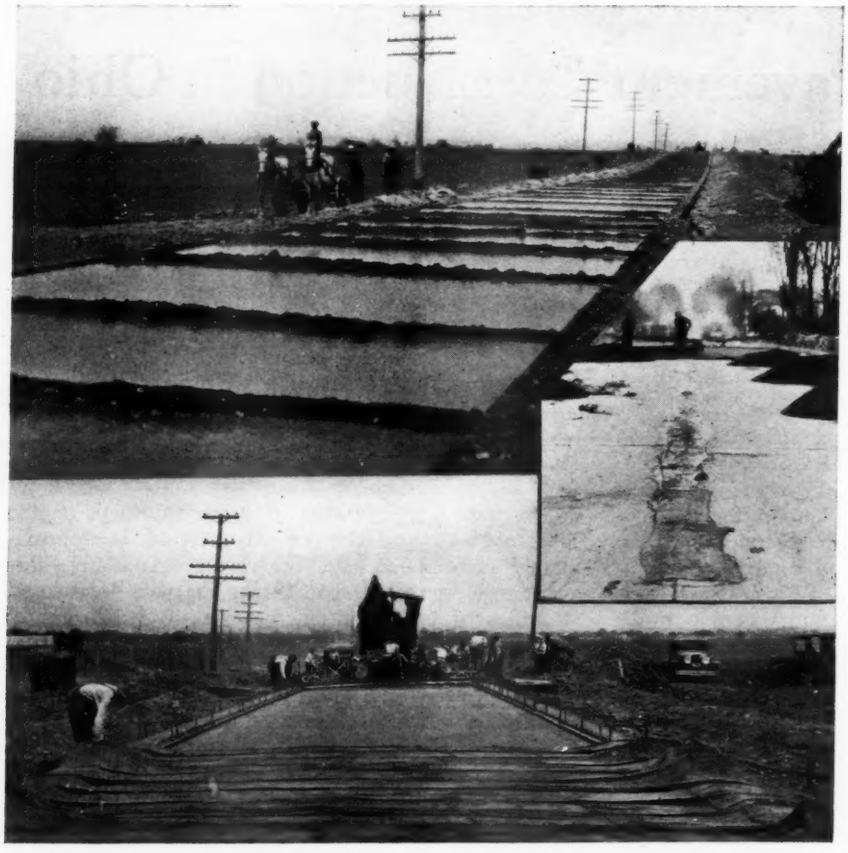
Construction of Base

Briefly, the concrete base proportions are: 1 sack of cement to not more than 7½ cubic feet of aggregate. Both the fine and coarse aggregate are weighed separately, the fine representing not less than 30% nor more than 40% of the total aggregate. Various tests and inspections are made during the course of the work, chief among which are the compressive strength and yield tests.

Where specified, the contraction joints are spaced at 25 to 30-foot intervals, with sleeved dowels at these joints—dowels being placed at a minimum of 4½ feet apart. Concrete laid after September 15th and before May 15th is required to have expansion joints placed at intervals of from 75 to 90 feet apart. Longitudinal center joints are generally used, being of either the impressed or the metal type, with dowels spaced at 5-foot intervals. In addition, a through edge-reinforcing bar, sleeved at the joints, is placed on both sides six inches from the edges of the pavement.

In special cases where soft or marshy sub-soil conditions are encountered, or where exceedingly heavy traffic is expected, a mesh fabric or steel mat reinforcement is used.

Surface finishings of the concrete base by a finishing machine and proper curing methods for the concrete are requirements of the specifications. The standard method of curing consists of first spraying the surface if it appears to be dry, after which wet burlap is used to cover base course. Within 24 hours it is removed and the surface is checked for smoothness, either a 10-foot straight edge or a templet of the cross section being used, and variations exceeding ⅜ inch are corrected while the concrete is green. Straw is then placed over the surface to a depth of 3 inches, thoroughly saturated with water and required to be kept wet for six days or longer, depending upon weather conditions.



Above—Curing concrete base by ponding. U. S. 23 south of Circleville. Below—Curing concrete base with wet burlap. North of Circleville. Insert at right—Joints in concrete base covered with strips of burlap, stuck in place with asphalt, to prevent foreign material entering joints

Before placing the brick wearing course, the base and all joints are cleaned. Expansion joints, which extend the full depth of the base 1 inch wide, consist of either a premolded joint material or poured bituminous filler material. All cracks and joints are covered with 12-inch width heavy burlap, held in place by a heavy coating of bituminous material.

Limited space permits a discussion of only the most important construction details of a concrete base. Many other features and requirements of materials, inspections and type of equipment used have been omitted. With this explanation we pass to the subject of a brick surface course and the methods of its construction.

Surface Course

A sand or granulated slag bed (more commonly known as cushion) of ¾" depth is spread uniformly over the

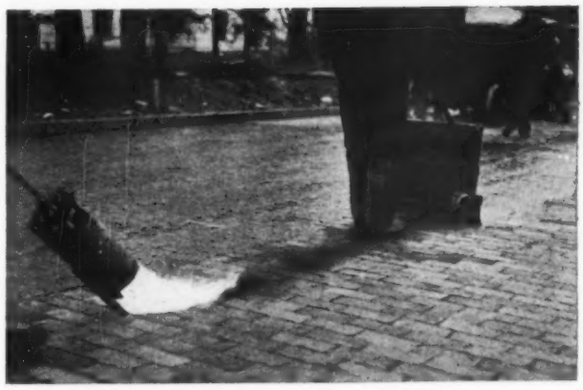
base. If slag is used, rolling with a tandem roller weighing not less than 5 tons is required. To attain a uniformly shaped and compacted bed, a templet of sufficient weight is drawn forward and backward until the desired depth and surface are produced. Specifications require that the sand used as a cushion pass a screen with ¼" openings and not less than 60% be retained on a No. 20 sieve. This sand must be produced from hard, durable stone. Granulated slag must be water or steam cooled, blast funace product, and not less than 95% pass ¼" circular opening screen.

Before the brick is permitted to be used, a rattler test of it is made. Samples of ten brick representing the average of the stock of brick to be shipped, are selected at the plant. Many of these plants are equipped with the standard rattler, and the test is made at the plant in the presence of a representative from the State's testing laboratory, in conformity with the requirements of the American Society of Testing Materials. This test, aside from the visual inspection of brick, furnishes the best method of determining the quality of the brick.

Preparatory to paving, the brick are carefully handled and neatly piled outside the curbs. From these piles, the bricks are carried to the brick layers by means of gravity carriers, more commonly referred to as roller conveyors. When the road is more than 30 feet wide, two conveyors are used, one on each side, opposite each other. The bricks are laid squarely upon the cushion, as closely together as possible and in straight courses across the pavement. The workmen are permitted to stand only on the newly laid brick. After a sufficient area of brick has been laid, the inspector examines the surface for soft, porous, chipped or irregular brick, marking same for removal. Acceptable brick must be substituted for those rejected. After the surface has been cleaned carefully the area is rolled with a 3 to 5-ton tandem roller. Rolling is commenced on the edge, moving slowly back and forth, overlapping its course each time until the center is reached. The same operation proceeds from the opposite side until the center is reached.

After the rolling, the surface is again inspected for broken or spalled brick and the same process of culling and replacement is made. Following this, a check is made of the uniformity of the surface. This is done by means of a 10 foot straight edge placed in a position parallel to the center line of the pavement. No variation greater than ¼", found within the length of the straight edge, is permitted. If rolling fails to produce desired smoothness, the brick are removed and the excess height or depression is adjusted in the sand cushion.

Filling the joints of the brick follows immediately, before dirt or foreign material has entered the joints. Although several different filler materials are permitted in Ohio's specifications, the most popular in use is the asphaltic filler. Before this application is started, the brick surface is cleaned and dried (if wet), and the sand cushion also must be free from water. The filler material is heated to a temperature of from 350 to 375 degrees Fahrenheit, in kettles equipped with a stationary thermometer. The filler material is drawn from these kettles and applied to



Surface heater used in advance of squeege buggy when temperature is below 50 degrees, to insure penetration of asphalt into the joints.

the brick at the specified temperature, and worked into the joints by means of a squeegee. This squeegee is usually mounted on a wheeled bucket from which the operator releases the filler material in such quantity as to completely fill the joints as it is being drawn at an angle with the joints in the surface. If the temperature is below 50 degrees, a surface heater is required to heat the brick and the squeegee follows immediately after and while the brick are still warm. Special care is taken to see that no excess filler material is left on the surface of the brick, and no surface irregularities are permitted to exceed 5/16 of an inch in any 10-foot length of pavement.

After the joints have been properly filled, a thin coating of dustless stone or slag screenings or coarse sand is spread over the surface. The road may be opened to traffic as soon as this final coating has been applied.

State Paves City Streets

Twenty per cent of the money appropriated by the State of Maryland for road building is allotted Baltimore City, and the paving is handled by the State Roads Commission. During 1930 the State Roads Commission completed a total of 227,162.47 square yards of improved paving in Baltimore City. This is equivalent to 12.9 miles based on a width of 30 feet between curbs, and is the largest yardage ever placed by this commission in the city in a single year.

Pedestrian Subways in Los Angeles

Prior to 1931 Los Angeles, Calif., to reduce the danger of accidents to its school children, built 48 pedestrian tunnels under busy streets near schools. There was some question whether the children would use these tunnels, but, owing partly to safety training in the schools and the school-boy safety patrols, there was general use of them; and partly, at least, because of them there was a gratifying reduction in motor vehicle accidents to children. Last spring the taxpayers voted bonds for building 50 more of these pedestrian tunnels.

In addition to reducing accidents, each tunnel permits releasing a traffic policeman formerly required to protect children on their way to and from school, and the saving of his salary will in many cases pay for the tunnel in three or four years.

New Developments in Use of Asphalt for Road Surfacing

By Bernard E. Gray
Highway Engineer, The Asphalt Institute

THE year 1931 has been one of unusual development and progress in the use of asphalt for road and street construction.

Probably the most outstanding forward step has been the adoption by The Asphalt Institute of a set of standard specifications covering liquid asphalt products. This move marks a definite advance on the part of the industry, in cooperation with state and national government engineering bodies, to simplify the practice of such work as surface treatments, road-mix surfaces and similar types. These specifications are seven in number, and by their use, either singly or in combination, any type of low-cost bituminous-treated surface may be built successfully. These specifications are briefly reviewed as follows:

Asphalt Material No. 1—A permanently non-hardening liquid product intended for a dust layer.

Asphalt Material No. 2—A liquid product readily and completely absorbed by earth, gravel and macadam surfaces, where it hardens in place. This material is intended solely for use as a primer for initial surface treatment of road surfaces preparatory to the application of more viscous products. Especial note should be taken of this material because it represents a high-grade asphalt cut-back which does everything that a primer can be expected to do. It has the ability to penetrate to such depth as will completely kill the dust and yet contains a sufficient amount of asphalt cement, so that, as the distillate evaporates, the surface is thoroughly hardened and bonded together.

Asphalt Material No. 3—A non-hardening liquid product intended for use in the construction of road-mix wearing courses of the fine-graded aggregate type in arid or semi-arid areas.

Asphalt Material No. 4—A liquid product of medium viscosity intended for use in the construction of road-mix surfaces, fine graded aggregate type, and adapted to areas of heavy traffic or severe climatic conditions.

Asphalt Material No. 5—A rapid-drying liquid product intended for use in the surface treatment and retreatment of bituminous roads, and also used for the binder in road-mix surfaces under cold weather conditions.

Asphalt Material No. 6—A rapid-drying liquid product intended to serve as a binder for cold patch mixtures, for pre-mixed aggregates or for road-mix surfaces, under conditions of cool weather.

Asphalt Material No. 7—A rapid-drying liquid product intended for use as binder in the construction of road-mix surfaces, macadam aggregate type, for warm weather mixing.

A review of these specifications clearly shows the wide range of usefulness, and yet the number of specifications is only seven. Already the benefits of such simplification have become apparent, and as further simplification takes place in the different states and the adoption of standard specifications becomes universal, construction methods will be improved and costs stabilized.

Mechanical Finishing

The second forward step during the year has been the greater use of mechanical finishing equipment for asphaltic concrete and sheet asphalt surfaces. It is the definite recommendation of the Institute that mechanical finishing be employed wherever possible. That such equipment has not been used to greater extent in previous years is a matter for considerable wonder, as the results obtained are so far superior to hand-finishing that no real comparison is possible. The advantages are, first—almost perfect surface smoothness may be achieved which is not exceeded by the finish possible on any other type of pavement; and second—the rate of construction is very materially increased and the cost accordingly reduced.

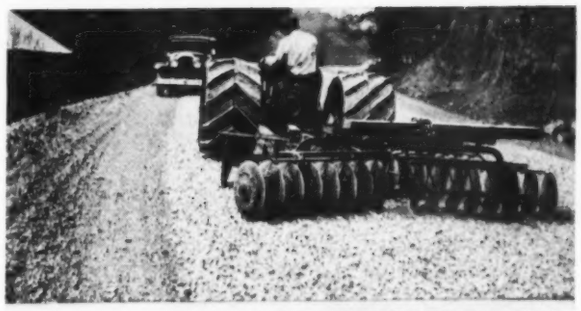
A typical California example is cited to show the progress in this respect. A seven and one-half mile project, having a thirty-foot width of finished roadway, with asphaltic concrete ranging from nine inches thick at the edge to three inches at the center, was completed in forty-one and one-half working days. The daily output was over one thousand tons and the price, complete in place, was $4.00 per ton. Comparative cost data on hand-finishing and machine-finishing definitely show that, with the same number of men, twice the yardage may be completed using the machine as when all hand labor is employed.

Finishing machine worked 1800 sq. yd. daily of hot mix on U. S. No. 20.

Road Mix Surfaces

Another important development of the past year has been the growing utilization of road-mix surfaces, wherein liquid asphalt is used for the binding agent. It is interesting to look back over the past few years and see how this development

has taken place. The early beginning of the road-mix surfaces occurred as the result of observation of surface treatments, where an excess of bitumen was used and additional cover coat was placed to take up the surplus. In order to avoid a bump at such places, the aggregate was broomed about so as to even off the particular area. In this brooming, the aggregate and the material become mixed and these particular areas resisted traffic better than those with the thinner surfaces. From this first observation developed the practice of dragging surface treatments as a whole, with a view to obtaining more uniform results, thus insuring the coating of the asphalt and its retention on the surface. The next step was the logical one of increasing the depth of the treatment by various methods of mixing. The first method employed different kinds of harrows and road graders, followed by the development of special drags, until today there are a number of such machines with multiple blades in long wheel-base frames, which achieve a degree of mixing in one or two passes over the road surface equal to six to fifteen passes with the road grader and harrow. Such developments, of course, have greatly speeded up the rate of construction, as well as improved the quality of the mix and permitted the use of a more viscous asphalt product, all of which is highly advantageous.



Asphalt Mixed-in-place Macadam

Top—Disking loose stone once or twice gives a thorough blending, and also gets rid of any dust pockets.
Middle—Distributor, working 25 miles from a railroad, was serviced by trailer tanks filled at the tank car; only a few minutes required for servicing.
Bottom—Surface is again thoroughly disked to insure thorough mixing and uniformity; then dragged continuously until asphalt sets up.

Portable Mixing Machines

In addition to the perfection of road-mixing methods, there have been a number of portable mixing machines which are forerunners of highly efficient plants for this purpose. In fact, one recently tested, which took in the mineral aggregate, accurately proportioned and mixed it with a measured amount of asphalt and then deposited the final mixture on the road surface, where it was mechanically finished, was of such high development as to indicate that such a plant is already available. This entire operation proceeded so that an output of forty-eight cubic feet per minute was achieved, equivalent to finished roadway twenty feet wide, at the rate of ten linear feet per minute. It is confidently predicted that a machine may be further developed and perfected, so that such output may be doubled. This makes possible the construction of a twenty-foot roadway, 2½ inches deep, at the rate of one to two miles per day.

Multiple-blade drag *Broom drag*

Both disker and drag are improvements over grader alone, giving more rapid mixing and a smoother surface.

Manuals on Asphalt Road Construction

Another step forward, and something which has been needed for a long time, is the beginning of a series of texts on the use of asphalt road construction which has been undertaken by the Institute. This undertaking is a task of considerable magnitude and the coperation of the highway engineering profession in putting out the first manual on road-mix types has been most gratifying. These texts are written by the staff of the Institute after a careful field inspection of work throughout the entire United States and conferences with the leading highway engineers most active in building the particular types. It is planned to issue some twelve to fourteen manuals, each one to deal with a particular type of asphalt construction, including all types of surface treatments, all types of hot-mix pavements, black base methods of maintenance, methods of reconstruction such as widening, resurfacing old pavements and subgrades, etc., etc.

In conclusion, it is confidently predicted that the country is entering upon a greater road program than ever. The method of procedure, however, will be radically different from that in the past. Today we

realize that the rapid increase in use of the improved highways was due to extraordinary increase in number of motor vehicles all trying to operate over this limited road mileage. Today the number of improved primary roads has been very greatly increased. Many of them, of course, are still too narrow or too thin or on improper locations, and such defects will have to be remedied at the earliest possible moment. But by and large, over the entire United States, new construction may confidently be undertaken with a very definite knowledge as to the traffic volume expected. Furthermore, researches have demonstrated that a wide variety of local aggregates, in combination with asphalt products, may be made into first-class road surfaces at a very moderate cost.

The trend of the future design, therefore, is in two principal groups, one—the low-cost road surface of a wide variety of types; and the other, the salvage of existing road surfaces, both on rural highways and in the city, by resurfacing, widening and building-up with hot asphaltic mixes laid with a mechanical finisher.

Rejuvenating Old Pavements in Charlotte

By Wayt Thomas
City engineer, Charlotte, N. C.

The City of Charlotte, North Carolina, has a number of old sheet asphalt, asphaltic concrete and concrete pavements which were badly checked and cracked. In some cases the smaller sections of pavement were loose on the base. In April, 1930, it was decided to surface treat some of these pavements with tar to see whether or not they could be reclaimed.

Previous to the treating operations, the streets were thoroughly swept to remove all dust, dirt, and other loose material. Cracks a quarter-inch wide or wider were swept clean with a hard broom and poured full of Tarvia XC (a refined tar having a float test at 50°C of 90 to 150 seconds). This material was heated to about 225°F in a tar kettle and poured with hand pouring pots. Narrow cracks were filled without cleaning while hair cracks were left open to be sealed with the surface treating tar. The tar in the wide cracks was covered with coarse sand or fine gravel to prevent picking up.

Tarvia-A (a refined surface treating tar having a float test at 32°C. of 120 to 180 seconds) was selected for the flush coat work. It was heated to between 200° and 220°F in the tank car and applied to the street by means of a motor distributor. Approximately one-third gallon of tar per square yard was used and this was sufficient in most cases. However, one or two of the old streets were very badly dried out and all of the tar went down into the pavement, so that it was necessary to make a second application in order to have sufficient tar on the surface to hold the covering material. In these cases the tar penetrated into the old pavement about a half-inch.

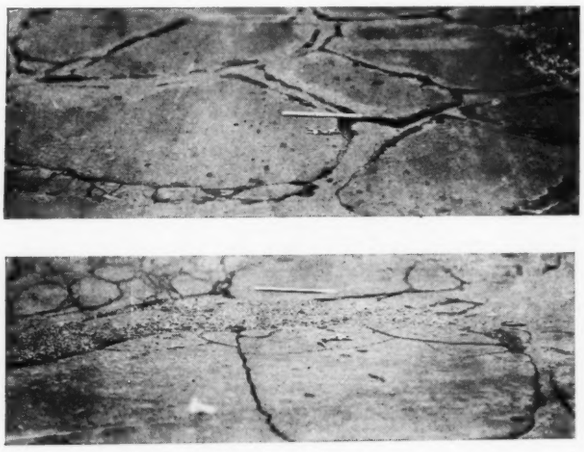
The hot tar was covered immediately with about 25 pounds per square yard of clean, washed "Mascot chatts," a limestone chip ranging in size from 10 mesh to ⅜". It is important that this material be clean and dry and applied soon after the tar has been spread.

The covering material was broomed out even with hand brooms and then rolled with a seven-ton roller at the rate of about sixty feet per minute.

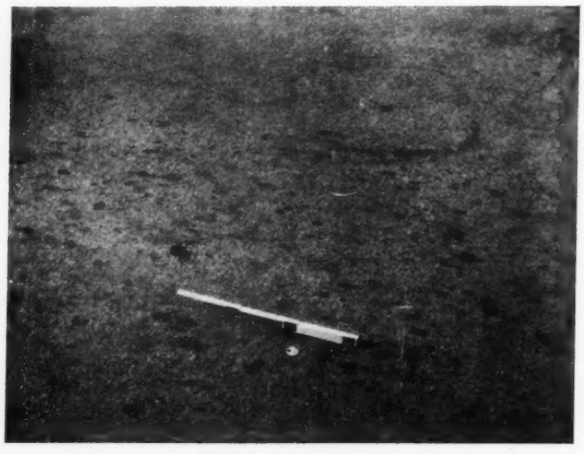
The tar surface treating material did not require a preliminary prime coat, and penetrated into the old surface and held the covering material tightly, forming a tough new skin on top of the old pavement. A gritty, non-skid surface was formed, and it has remained non-skid with no tendency for the tar to bleed up over the aggregate and require additional covering material at a later date.

Approximately 28,000 square yards of this work was done in April, 1930, and an additional 130,000 square yards in May and June, 1930; all by contract, under the direction of the writer. This treatment cost from ten to twelve cents per square yard. Maintenance costs have been greatly reduced by this procedure, since all of the work is done at one time and continuous repairs are not necessary.

This procedure has saved the original investment in the old pavements and renewed their life for a period of from three to five years, after which time we estimate an additional treatment will be necessary.



Charlotte streets before treatment.



Surface after treatment.

1931 Accomplishments in Concrete Paving

By W. E. Barker
Highway Engineer, Portland Cement Association

ALTHOUGH 1931 will be long remembered as a year of great depression in general business, it was the year of greatest activity in the construction of concrete roads, a total of 111,000,000 square yards of these having been placed under contract during the twelve months. This is about 3,000,000 square yards greater than the best previous year, which was 1930. However, due to a marked decline in municipal construction work of all sorts, the street yardage dropped off sharply to a total of 24,000,000 square yards, which is the lowest figure since 1922.

In addition to amount of road paving, there were noteworthy accomplishments in research, design, and construction of concrete pavements during 1930, the most important of which will be described briefly.

Research

The outstanding research made recently is the Tennessee curing experiment. This was conducted in 1929 and 1930 but the results and conclusions were not published until 1931.

The test pavement was 14 miles long. The north half of the pavement was separated from the south half by a longitudinal joint, without the usual tie-bars, and was cured by the contractor in the standard manner which requires 24 hours of wet burlap followed by a two-inch layer of earth kept wet for ten days.

The southern half of the pavement was cured by the state forces in various ways. There were sections cured with wet burlap for 12 hours, 24 hours, 48 hours, 72 hours, and 96 hours. One section was not cured at all. Sisalkraft paper was kept over one section for 24 hours. Two sections were cured with sodium silicate, in one of which the concrete was laid directly on the earth subgrade and in the other on tar paper. A surface application of calcium chloride, and five different methods of curing with a bituminous surface coating were also used, with part of the section on an earth subgrade and part on tar paper. A calcium chloride admixture was used in one section and here again the concrete was placed partly on earth and partly on tar paper. A section devoted to poor earth curing and another devoted to ponding completed the experiments.

The important conclusions were that 24 to 96 hours of burlap curing were nearly as good as the standard curing method; that Sisalkraft paper and calcium chloride surface applications gave results nearly as satisfactory as the standard method; that sodium silicate was somewhat less satisfactory than the standard method; that it probably is not necessary to keep an earth blanket saturated as long as is done in the standard method; that bituminous surface coatings were unsatisfactory because they increased transverse cracking; and that there is nothing to be gained by the use of tar paper on the subgrade.

The practical results of the tests have been an increased preference for water curing, and great interest in the possibility of completing the curing by a 72-hour application of wet burlap. It is reported that the U. S. Bureau of Public Roads now permits 72-hour burlap curing for Federal aid pavement. Cost estimates indicate that such curing costs only about 2½ cents per square yard as compared with 4 to 4½ cents for 24-hour burlap plus 10 days of water curing.

In a research conducted in Georgia, the amount of load carried across various types of joints was determined by placing a load on the slab end on one side of the joint and measuring the deflection of that slab and the slab across the joint. The deflections were then compared to learn the relative support of load. Tests were made on the ordinary "V" type deformed plate joints held together by tie-bars, on a 2-inch undoweled open transverse joint, on a transverse crack 1/16-inch wide, and on a doweled transverse joint ½-inch wide. The dowels were placed 2-feet 8-inches apart and were ¾-inch round smooth bars 4-feet long. They were dipped in heavy oil to break the bond between the bar and the concrete in one slab.

It was concluded that the deformed plate center joint was very effective, transferring an average of 50 per cent of the load across the joint. Dowels across the ½-inch joint proved a failure, transmitting only an average of 11 per cent, while the same percentage was transmitted by the undoweled 2-inch joint. Twenty-eight per cent of the load was transmitted across the transverse crack.

As opposed to the findings of this research, a condition survey of doweled and undoweled 4-inch resurfacing slabs made in California discovered fairly conclusive evidence that dowels *were* of value. On different sections of the same road, carrying the same traffic, there were less failures at doweled joints than at open joints. The value of special reinforcement adjacent to transverse joints was also indicated in the findings of the survey. Since cracks parallel to the joint and assumed to have been caused by load occur 3 to 5 feet from the joint, it seems that reinforcement designed to replace dowels should extend that far back from the joint.

In a report, as yet unpublished, of a survey carried on in eleven states, it is pointed out that increasing the thickness of slabs decreases the number of cracks caused by load but does not decrease the number caused by contraction, both conclusions agreeing with theoretical analysis. It is also concluded that reinforcement does not materially affect the ultimate average uncracked slab lengths of concrete pavement, but that the type of coarse aggregate does affect slab lengths, as do also subgrade and climate. The joint spacing required to control transverse cracking was found to range between 20 and 45 feet, with the great majority of pavements requiring a spacing of 20 to 30 feet.

Unusual Design Features

The Tennessee Highway Department has included a unique but very satisfactory design in pavements built recently. Instead of the usual parabolic crown, highest at the center, the slab is a plane, sloping all in one direction. The direction of slope is determined by the curves in the road. When pavement on a curve is super-elevated, it is tipped toward the inside of the

curve. Tangent sections leaving the curve slope in the same direction. When another curve is approached on which the super-elevation is in the opposite direction, the slope of the tangent is changed to agree with slope of the curve. This design feature has been found perfectly acceptable to traffic and it facilitates the finishing of curves, since the same strike-off template is used on the curve as is used on the straight section of the pavement.

In some parts of the country it has been found necessary to place transverse joints at short intervals if transverse cracking is to be controlled, while in other localities comparatively long joint spacings have been found satisfactory. On the Pacific Coast, for example, where adobe subgrades are common, a 20-foot transverse joint spacing is desirable, and is used in all three Pacific Coast States. (Seattle uses a 15-foot joint spacing.) In the southeastern states, however, where both climate and subgrade are about ideal, joint spacings of 40-feet have been found entirely satisfactory.

Two states, Iowa and Oklahoma, are building thicker slabs than those in common use in the other 46 states. Since the beginning of the thickened edge design, Iowa has built slabs 18-feet wide and having an edge thickness of 10 inches reduced in 2 feet to 7 inches, as compared with the 9-6-9 or 9-7-9 sections in common use in other states. In some places a lip curb 3 inches high is built monolithic with the pavement, making the total edge thickness 13 inches. In 1930 the Oklahoma Highway Department took alternate bids on a slab 20-feet wide and 9-6-9 or 10-7-10 inches in cross section. Bids for the 10-7-10 sections were only $2,480 higher per mile than for the pavement 1 inch thinner. This seemed to be a cheap price to pay for slab which was 11 per cent thicker and 23 per cent stronger, so the contract was let for the 10-7-10 slab and it was adopted as standard for all state highways. This extra thickness seems justified in Iowa, where it has been used long enough to demonstrate that the state highway system is remarkably free from failures of every sort. The state of Washington has used the 10-7-10 cross section for pavements on the heavily traveled Pacific Highway, and other states use it in the vicinity of large cities.

For 1931 construction, the states of Missouri, Kansas and Nebraska changed from 9-6-9 cross section to the 9-7-9.

Iowa also began the use of what is known as the lip curb—a curb 3 inches high with a face so nearly flat that vehicles can run over it without danger. It was first used in cuts to make a side ditch unnecessary and materially reduce the quantity of excavation. It was later placed on the low side of super-elevated curves and at other locations where water running from the pavement might erode the shoulder. Similar curb has been adopted by the highway department of Minnesota, Kansas, Oklahoma, Missouri, and to a limited extent by other states.

Lip curb seems to have several disadvantages, which may or may not outweigh the advantages. It would make widening of the pavement almost impossible, and it holds water on the pavement where, during the winter time, it is frozen and becomes a traffic hazard. During torrential rains the absence of a side ditch in cuts results in mud being washed down on the pavement, forming a slippery coating which extends to the nearest catch basin. This is encountered when least expected and has been the cause of some fatal accidents.

The design committee of the American Association of State Highway Officials, at the meeting in Salt Lake City in September, 1931, adopted as standard practice that transverse crack control should be obtained by the use of transverse joints spaced at from 20 to 50-foot intervals, depending upon the soil, climate or aggregates; also that a 1-inch expansion space should be allowed for each 100 feet of pavement, except where special conditions make a smaller allowance possible. It was also recommended that ample provision for expansion be allowed adjacent to bridges, widened intersections and other rigid structures within the pavement area.

Construction

During 1931 the Texas Highway Department purchased, from the original owner, the patent on the sawdust type of expansion joint. Sawdust joints have been used in Texas for a number of years with apparent success. In some instances the sawdust is impregnated with bitumen by mixing one part of asphalt, one part of crude oil and 15 parts of sawdust. The oil and asphalt are heated together until they are about ready to burn and then the sawdust is mixed with them. A coarse pine sawdust seems to work better than a finer hardwood sawdust. The material is allowed to cool, is then put in sacks and is forced cold into the joint by light tamping. Usually the sawdust is not mixed with asphalt or oil, but is lightly tamped into the joint and then covered with a seal coat of poured bituminous material. Sawdust has the desirable property of compressing as the joint closes and then expanding again to keep the joint filled as it opens. It is also cheap and is readily cleaned out and replaced by new material.

The majority of engineers think the ideal joint material would be one which would compress as the joint closed and then expand as the joint opened, keeping the space continually filled and preventing the entrance of any foreign material. Rubber joint material has both of these qualifications and has been used for several years in California and occasionally in other parts of the country. Rubber joint material costs more than the more common bituminous filler and there is still some question concerning its length of life, so it has not yet been generally adopted.

At least two of the metal joints used keep the joint space closed to dirt. One is in the shape of a narrow U with a depth slightly less than that of the pavement, the upper end closed with a bellows-shaped piece of rust resistant metal; each side of the U being anchored to one of the two slabs. This has been used in Connecticut, Iowa and other states. Another consists of two built up channels, one slightly narrower than the other and nesting into it. These are fastened, one to each slab, with the channel openings facing and the narrower inside the wider; the width of flanges being such that the two never entirely separate. This serves as both joint and dowel.

In building the 20-foot slab of the "Dunes Relief Highway," two 27-foot mixers were used abreast. The only actual connection between the two mixers was

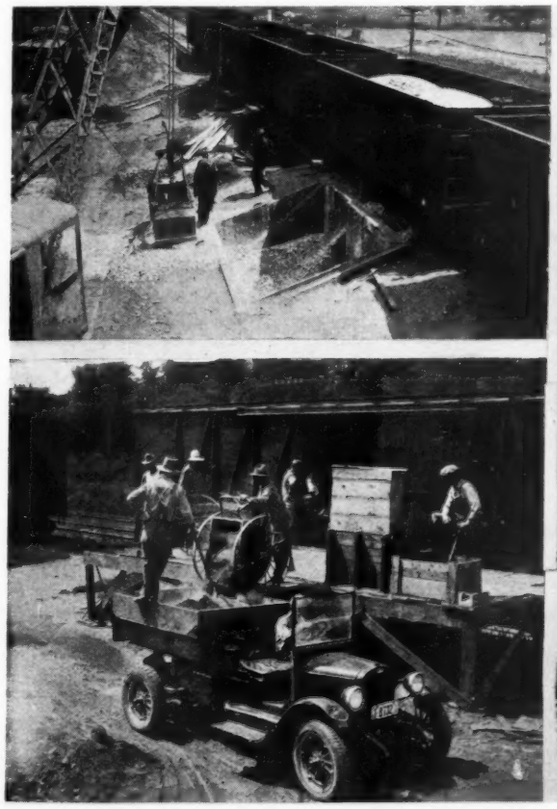
the water line which ran through one mixer to the other. The connection was a sufficient length of rubber hose to allow for small differences in movement as the mixer advanced, but it was found that work progressed better when the mixer operation was synchronized, so each was charged and discharged simultaneously. This made possible a comparison of the efficiency of a new mixer on which charging and discharging were more or less automatic and an old mixer where a lever had to be pulled for each charging and discharging operation. It was found that the new mixer had to wait for the old one on every batch.

A new type of longitudinal center joint, which is a combination of dummy joint and depressed traffic line, is being used by the Minnesota Highway Department. (This is described on page 34.)

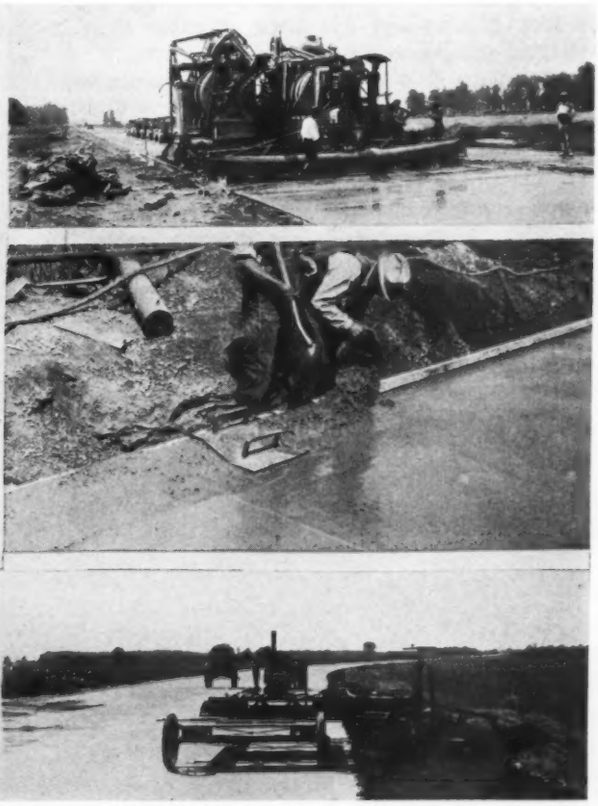
Several years ago the Iowa Highway Commission found it necessary to use tar paper on loess subgrades, which are prevalent in the northwestern part of the state, because they absorbed water so rapidly from the concrete that serious hair-checking resulted. The subgrade could not be sprinkled sufficiently to prevent this hair-checking without becoming so muddy concrete could not be laid upon it. The tar paper proved so satisfactory for this purpose that it was adopted for general use on all types of subgrades, as a substitute for wetting. Tests made in California indicate that concrete laid on tar paper has a lower strength than similar concrete laid on natural soil, probably because the natural soil takes out some water before the concrete begins to harden, reducing the water-cement ratio sufficiently to raise the strength of the slab.

During 1930 several contractors hitched two mixers in tandem and reduced the over-all time per batch from the accepted minimum of 75 seconds for a single mixer, to 50 seconds. The batch was first placed in the leading mixer and turned for 34 seconds. Water was added in this first drum. The batch was then discharged into the skip of the second mixer and from there into the second mixer's drum where it was turned for the balance of the 60-second mixing period. It was found that this 50 per cent greater hourly production was secured with the addition of only 5 or 6 men to the mixing and finishing crew. Tandem mixers were used more generally in 1931 than in 1930 but were definitely prohibited in at least one state and in another it was required that the batch remain in the first mixer for at least half the total mixing time.

On May 18, 1931, the Glassell-Cochran Company of Shreveport, Louisiana, broke all previous pavement laying records by placing 2653 lineal feet of 18-foot 8-6-8 slab in a single day. When calculated on a square yardage basis only, this is not the largest amount of pavement laid in a single day, as William Meneely built 2670 feet of 18-foot 9-6-9 pavement in a day in Southern Illinois. But the Illinois pavement required only 1858 cubic yards of concrete per mile while the Louisiana section required 1956 cubic yards per mile. Based on cubic yards mixed, which is the real measure of production, the Louisiana contractor produced the most concrete and should, therefore, be accorded the world's record.



Top—Pits beside the track into which aggregates are dropped from bottom dump gondolas, save the labor of cleaning up cars.
Bottom—It costs from 5 to 5½ cents per barrel, in Iowa, to unload and batch bulk cement by hand.



Top—Two 27-foot mixers, working abreast between forms on a 20-foot pavement slab.
Middle—Constructing lip curb in Iowa.
Bottom—A machine which shapes earth shoulders, after the slab is completed.

Improving Appearance of Jersey City Sewage Disposal Grounds

By Willard C. Mallalieu

Sanitary Engineer, Department of Streets and Public Improvements, Jersey City, N. J.

Office of Jersey City Disposal Works.

JERSEY CITY, N. J., has constructed and operates a sewage disposal plant in the Rockaway river valley on the outskirts of Boonton, N. J. It is under the direction of Commissioner Michael I. Fagen of the Department of Streets and Public Improvements, and more particularly is a part of the water bureau, as its primary function is the protection of the city's own water supply, through the diversion of the sewage originating in the water shed, to a site immediately below the reservoir dam.

Its location and construction aroused much opposition from the residents of this area, finally reaching the courts. However, the plans were approved, with certain reservations, and the work was completed.

The plant is spread over an area of about twenty-two acres, room being left adjacent to each unit to either enlarge or duplicate it when necessity arises. This lack of crowding has been of great help in beautifying the grounds.

The treatment of the sewage consists of plain sedimentation and separate sludge digestion, with both series of tanks being roofed and earthed over, and with terraced sides; glass covered sludge drying beds, contact beds, slow sand filters, and final sterilization with detention tanks.

While every precaution had been taken toward the elimination of nuisance in plant design, still the location of a residential section of Boonton on higher ground and within one thousand yards of the plant in the path of prevailing winds caused all sorts of dire predictions and, together with the effects of the earlier agitation, much local hostility. Now, after three years of operation without nuisance and through the gradual improvement of the grounds, this feeling has been entirely overcome, and the plant is looked upon as a park and a desirable place to drive through and visit.

The above result has been accomplished with an extremely small expenditure, (about nine hundred dollars over a period of five years), excepting spare-time labor or by-products of some necessary plant or watershed function, such as using the waste earth from a diversion ditch for grading.

The accompanying views were made in October 1930, since which time many improvements have been introduced; for example, in the general view of the plant from the settling tanks (Fig. 1), the rough ungraded area in the foreground has been converted into a bed of white nicotiana, about 110 by 135 feet in extent, at a cost of twelve dollars for plowing and grading and fifty cents for seed. This plant blooms at night and gives off a spicy attractive fragrance, noticeable for a considerable distance and as far removed as possible from the odor usually associated with sewage plants.

At its completion, the plant contained two bog areas, in which all the discarded odds and ends of construction had accumulated, as is usual in such cases; their present condition is illustrated by Figs. 2 and 3, and perhaps a brief analysis of these pictures will give much of the story of the plant's landscaping.

In the filled-in area opposite the contact beds (Fig. 2), the lily pools, used also for experimental purposes, are 21 inches deep on the inside and are con-

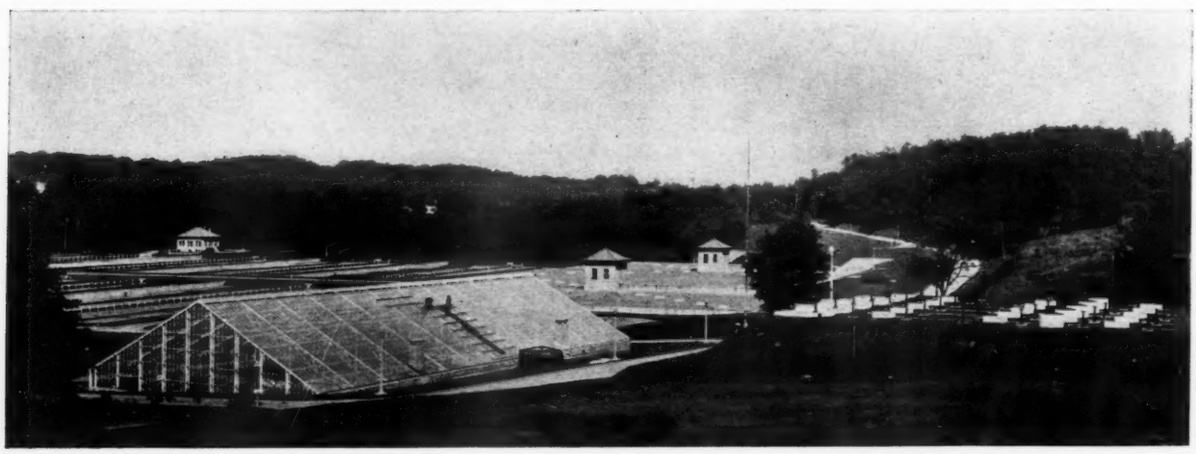


Fig. 1—General view of Jersey City's sewage treatment plant, from settling tanks.

Fig. 2. View of filled-in bog area across main road from contact beds.

Fig. 3. Pool and rock garden between contact beds and sand washer; formerly a bog area.

structed largely of rocks removed from that area of the plant where lawns were to be made; in their construction no excavation was necessary as the fill here was three feet deep in some places, the material used was a sandy gravel, entirely devoid of humus, removed from a diversion ditch constructed to protect the reservoir. At the time this picture was taken the lawn was only about five months old, showing what even the poorest soils will do if given a heavy surfacing with sludge. The hawthorn hedge in the upper left center of the picture is our one extravagance; however, it is no more costly than a fence, and equally effective while more sightly. The white birches at the right of the pools were brought from the woods, and the low-lying clump at their right is wild iris brought from along the river. The privet hedge along the road near the culvert is from clippings rooted in the nursery from an existing hedge at the reservoir, and the culvert coping is from broken pudding stone removed in grading. Also used in this area, but outside the limits of the picture, is Japanese barberry which the birds had seeded in the woods from ornamental plantings in the neighborhood.

In the other bog area (Fig. 3), the pond was gradually excavated, the sides walled up with waste stone and about four dollars worth of common water lily roots planted, and on the banks rhododendrons and laurel, partly from the woods, were planted. The rock garden at the upper right center is made from broken pudding stone, an attractive reddish conglomerate with included white pebbles, found locally, and about forty cents worth of portulacca seed, planted several years ago, has come up every season to make this a cheerful and attractive spot.

Lilac bushes and other shrubs are found around old foundations in the watershed, and salvaged for use, while other perennials and annuals are obtained by trading seeds and cuttings.

A program of reforestation with evergreens on the reservoir marginal area has made a nursery advisable, and this is located at the right of the small building shown in the left background of Fig. 1.

As complaints regarding sewage plant nuisances are at least fifty percent imaginary, and as an attractive appearance does much to eliminate or at least reduce such criticism, it seems unfortunate that an apparent difference of opinion as to the value of sewage plant beautification has arisen. Prof. Geo. M. Merrill seemingly takes the opposite side of this question in his paper before the Oklahoma Water and Sewage Short Course, when he states that "gaudy flowers and ostentatious shrubs or trees are as inappropriate as an attempt to make a lavatory a center of attraction by decorating or by calling special attention to it." To my mind such a statement loses much of its weight through the fact that such a combination would be equally objectionable on any area.

Let us hope that in the not too distant future, through the medium of a scoring system or by any other plan, some competitive feeling may be introduced into sewage plant design and operation, in which the eye, equally with the nose, is given consideration.

Fig. 4. Center drive where it passes between sand filters.

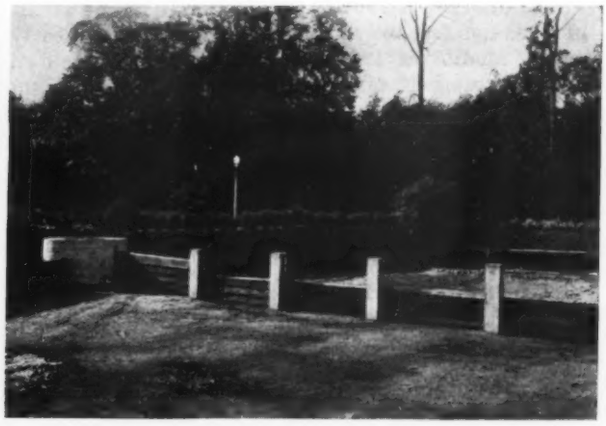


Fig. 5. Corner of sand filters. Center drive at left.

Water Supply, Sewage Treatment and Refuse Disposal in 1931

By H. Burdett Cleveland,
Consulting Sanitary Engineer, New York

WATER SUPPLY

MANAGEMENT and Control. The most important happenings in 1931 as affecting the larger unsolved problems of water supply demand throughout the country, present and future, has been the rational, clear-cut decision of the United States Supreme Court on the fundamental question of allocation of sources between states, adjudicated for the first time.

On February 24 the Court handed down its decision in the suit brought by Connecticut against Massachusetts to prevent the proposed diversion of water from the Swift and Ware rivers, tributary through the Chicopee river to the Connecticut river, a project of the Metropolitan District (Boston) Water Supply Commission.

Connecticut's bill of complaint was dismissed (the Court upholding the Special Master's finding of fact and law) without prejudice to Connecticut's right to maintain a suit against Massachusetts whenever it shall appear that substantial interests of Connecticut are being injured through a material increase of the amount of water being diverted above the amount allowed by permits from the War Department.

Following the decision of the Connecticut-Massachusetts case, the Court adopted the recommendations of the Special Master appointed to make findings of fact and conclusions of law and to propose a decree, and allowed the diversion by New York City of 440 m.g.d. of water from tributaries of the Delaware river. Suit against such diversion was brought by New Jersey in 1929, the State of Pennsylvania intervening later. Among the stipulations in the decision was included provision for the maintenance of a certain minimum flow in the main river.

Increased activity has been shown in the formation of joint water supply districts, the economic and other benefits arising from such concerted action having been emphasized by the occurrence, or the threat, of water supply shortage in many districts as a result of the drought of 1930 and the early months of 1931.

The drought of 1930-31 was broken in most sections of the country by abundant rainfall in the early spring months of 1931, but the effect is still felt on reserve storage of many water supplies. The drought has shattered earlier records of rainfall deficiency over many watersheds and the information available points to the need for revision of some previously accepted safe yield figures.

The purchase of privately owned public water supply systems and their management by holding companies has slowed down considerably during the past year or two owing, in part, without doubt, to the stringent financial situation and in part to income difficulties, presumably arising, in some cases, from over-capitalization due to excessive prices paid for some of the systems purchased.

Shortsightedness and timidity on the part of public authorities are losing, for many municipalities, the benefits of low cost for needed public improvements. It would seem that old style town meetings, with the situation fully explained to taxpayers, might prevent such uneconomic delay.

Construction. The total volume of water works construction fell off considerably through the year, although there were many large water supply projects under construction and considerable activity in expansion of sources as a result of shortage due to rainfall deficiency during the previous year and the first three months of 1931.

The project of the Metropolitan Water District of Southern California, involving an expenditure of at least $220,000,000 and constituting one of the largest single bond issues in water-works construction history, was authorized by the voters on September 29.

An aqueduct 252 miles long will convey water from the Colorado river to Los Angeles, Pasadena, Glendale, Long Beach and ten other cities.

Toledo is planning a new system with Lake Erie as the source.

Work is progressing on the second pressure tunnel under New York City, on the Cobble Mountain (Springfield, Mass.) development, the Swift and Ware rivers project (Boston), the Hetch Hetchy (San Francisco) project and on several other large improvements.

WATER SUPPLY TREATMENT

The Committee on Water Works Practice of the American Water Works Association has published a report of the highly varied types of study which have been conducted under its direction by many agencies, dealing principally with treatment problems.

Processes. Intensive study and plant-scale tests are being given to the ammonia-chlorine, or chloramine, process for taste removal and to the application of activated carbon for taste and odor removal.

Continued tests and wider application of chloramine treatment have been in evidence during the year, especially at St. Cloud, Minn., Cleveland, Ottawa, and Denver.

The outstanding advance of the year in water supply treatment has been the relatively great increase and the success obtained in the application of powdered activated carbon for taste and odor removal. The application of powdered activated carbon before filtration is proving, in nearly all instances reported, an effective and economical process for the removal of tastes and odors from public water supplies, following studies of the use of carbon in 1928 at Chicago, at Cleveland, at Chester, Pa., and at other cities and more especially following its use in powdered form at Hackensack, N. J. The process was adopted at some 30 or more plants during the year, its use having been advised, as in the case of recommendations made by the Ohio River Board of Engineers, to overcome, more especially, the ill effects of drought

conditions on the esthetic qualities of potable water.

The process of superchlorination of water and dechlorination by sulfur dioxide to remove excess chlorine has continued in favor at many filter plants.

In filter plant design, concerted study is being given to the most favorable effective or typical size of sand particle in filter beds and to the possibility of increasing wash water rates.

SEWAGE TREATMENT

General. River cleansing, the principal objective of sewage treatment projects, has been given considerable prominence during the year, the need for remedial action to eliminate pollution of streams having been emphasized by recent low stream flows resulting from drought conditions.

Two notable instances of official action to secure greater progress in the proper treatment of sewage before its discharge into waterways and in the prevention of oil waste discharge were reported during 1931.

A committee of seven engineers, representing four of the major national engineering societies, with Robert Spurr Weston as Chairman and Abel Wolman as Secretary, was appointed early in the year by the American Engineering Council to aid in framing laws prohibiting "the further unnecessary and wanton pollution of all waters under the Federal and State governments."

For the purpose of recommending a treaty between New York, New Jersey and Connecticut, the legislatures of these states during the 1931 sessions authorized the appointment of a commission in each state to confer with the other commissions and agree upon a treaty between the three states and the Federal government which shall cover all matters relating to the pollution of natural waterways between the states.

Additional schools for training sewage plant operators have been established during the year and the movement to license properly qualified operators is gaining ground. It is generally recognized that the saying, "A poor sewage treatment plant with a good operator produces better results than a good plant with a poor operator," embodies a good deal of truth.

Organization of joint sewer districts and metropolitan boards, to make possible the economical and effective collection and treatment of sewage by arranging that sewer system planning shall conform to natural drainage areas, has proceeded during the year. Instances of such development have been the proposal to form a metropolitan district for Seattle and the area to the north of the city, and definite progress in the formation of a metropolitan district embracing Minneapolis and St. Cloud. The completion of works for the Salem and Danbury (Massachusetts) district, known as the South Essex Sanitary District, has been reported.

Construction. Contract has been awarded to the American Construction Company of Cleveland for the construction of aeration and sludge-settling tanks for the Easterly sewage treatment plant, forming a part of the $12,000,000 projected works for the city of Cleveland.

Many other large projects, including the Ward's Island activated sludge plant, New York, are under construction, but total sewage works construction decreased during the year.

Processes. An interesting experiment in sewage treatment along combined mechanical and chemical lines is being tried at Dearborn, Mich. It is reported that in the new plant, lime, ferric chloride and paper pulp are added to the sewage, which then passes through a baffled mixing chamber and into a circular Dorr clarifier. In leaving the clarifier the effluent flows upward through a filter located annularly around the inside of the clarifier tank, is then chlorinated and discharged into the river. The lime used will be secured from a nearby Prestolite plant at little cost. Cleaning of the sand filter, composed of magnetite sand, will be accomplished by passing a solenoid over the surface to raise the sand for a short interval from the fine screen bottom, thus allowing clarified effluent to "rush up and wash the sand." The process was tried out at Dearborn during 1930 in a half million gallon daily flow plant. The sum of $455,000 has been invested in a new plant of this type with an expected capacity of 6 m.g.d. The plant was to be in operation in January, 1932.

In sewage treatment practice, attention has been given to the possibilities of multiple stage digestion of sludge, to wider application of prechlorination for odor control and reduction of BOD as well as for disinfection, and to utilization of digestion tank gas for power purposes.

REFUSE DISPOSAL

General. The suit of New Jersey against the State of New York asking that New York City be required to stop dumping garbage at sea has been successful and the United States Supreme Court has set June 1, 1933 as the date on which such dumping shall cease. Sites for four refuse incinerators have been approved by the Board of Estimate, the estimated cost of the four plants being $4,400,000.

A very much worth while compilation of data on the practice and experience of municipalities in the collection and incineration of municipal refuse has been undertaken by the International Association of Public Works Officials by the preparation and furnishing of standard forms for the recording of such information.

Construction. Some of the larger refuse incinerators completed in 1931 were plants at Cincinnati, Patchogue, N. Y., Irvington, N. J., Garden City, N. Y., Red Bank, N. J., Erie, Pa., Fort Wayne, Ind., Montreal, Que., Pelham Manor, N. Y., and Mansfield, Ohio.

No new reduction plants have been built. The percentage of plants employing reduction has dropped from 12% of the total number of plants in 1906 to 2% in 1931.

Incinerators for Small Communities

Two small shore resorts on Fire Island beach, New York, Ocean Beach, with 2500 summer population, and Saltaire with perhaps 500, are burning their rubbish in incinerators. The Ocean Beach incinerator, constructed by the Pittsburg-Des Moines Steel Co., has a guaranteed capacity of 5 tons of garbage and rubbish in 8 hours (it can probably burn 10 tons) and cost $16,000. The Saltaire incinerator is merely a furnace and brick stack, not enclosed in a house, with a capacity of 750 pounds a day and cost $6,500.

Centralized Purchasing in Norwood, Massachusetts

By C. A. Bingham
City Manager, Norwood, Mass.

BY the charter of Norwood, approved March 18, 1914, the purchasing of equipment and supplies for every department of the town was placed in the hands of the town manager. The schools and library were included with all other departments. While the town manager's office was established January 1, 1915, the system of purchases was not installed until March of that year. Since that time 20,291 orders have been issued, or an average of 1270 per year.

During the past two years the number of orders has been greatly reduced because of the fact that, through an agreement suggested by the manager and adopted by the school department, the purchase of ordinary school supplies was taken care of entirely in the office of the superintendent of schools. This suggestion was made because, after a checkup, it was found that 58% of the work in the manager's office on purchasing was being done for school department use, and on the class of purchases made, namely class room supplies, there was only one price regardless of what office ordered these. Furthermore, it was much easier to check the receipt and disbursements of such supplies through the office of the superintendent than through the town manager's office. The manager still purchases materials used in any other way except class room work; and also repairs all school buildings and library buildings. He also requires that all invoices for school supplies and materials, even when purchased by the school superintendent, shall come to the manager for approval before payment, and occasionally questions are raised or discounts taken by him; but as a whole, the method of allowing the school superintendent to purchase his ordinary supplies has worked to the mutual advantage of both departments.

To show the reduction of orders since this scheme has been put into effect, it can be stated that in 1928 there were 1259 orders issued from the manager's office, of which 513 were for school supplies while in 1929 only 893 orders were issued and in 1930, 934 orders were issued. In 1928 the total of all invoices approved by the manager amounted to $369,705 and the cash discounts received were $2806. In 1929, 720 requisitions were received, 94 written quotations received, 893 orders sent out, 3361 invoices paid to 279 different firms amounting to $336,808. The cash discounts were $2839. In 1930, 727 requisitions were received and 139 written quotations; 934 orders were sent out to 268 different firms; 3464 invoices were paid totalling $362,850 and the cash discounts totalled $3430.

While the cash discounts each year pay more than double the actual cost of operating the purchasing division, yet the greatest savings come in the strict competition followed and in the receiving of special trade discounts. During one of the earlier years of centralized purchasing in Norwood, an absolute checkup was made throughout the year on this class of savings and it was found that $15,290.60 was saved. At that time the population was about 12,000 which would show a per capita annual savings through centralized purchasing of $1.27. Using this figure on the present population of nearly 16,000 it can be very well claimed that the purchasing department in Norwood is saving $20,000 a year.

The system is not at all intricate and has easily been put in effect in some eight or ten other cities in various parts of the country. In the first place, all forms are 5½ x 8½, or one-half correspondence size. These forms are easy to accompany with letters, easy to place in envelopes of the open face type and are easily filed in drawers which are neither too small nor too large. All the forms and records are of course indexed both numerically and alphabetically by tabs, and likewise colored metal clips are used to show orders or acknowledgements not received or invoices not checked.

The first form, in two parts, is the requisition which must be submitted by every department head for any supplies desired. As far as possible, department heads have been requested to submit as few separate requisitions as possible by combining as many requirements as possible on the one requisition.

The second copy is maintained in the files of the department making the requisition, for further checkup should they not receive a copy of the resulting order in due time, and also for their information on future requisitions. The card on which the data concerning requisitions are indexed contains sufficient columns and headings for all the necessary information.

The third form is a quotation form in duplicate, filled out as to requirements and mailed to prospective bidders by the purchasing department when sufficient time can be allowed. Otherwise, quotations are received over the telephone.

The original quotation form is, of course, filed and the data transferred onto a card index filed under the heading of the material quoted upon, and the card contains the quotations of all dealers over a period of time, which makes very ready reference and gives valuable data and market fluctuations.

The second copy of the quotation is of course kept by the person or firm making the quotation.

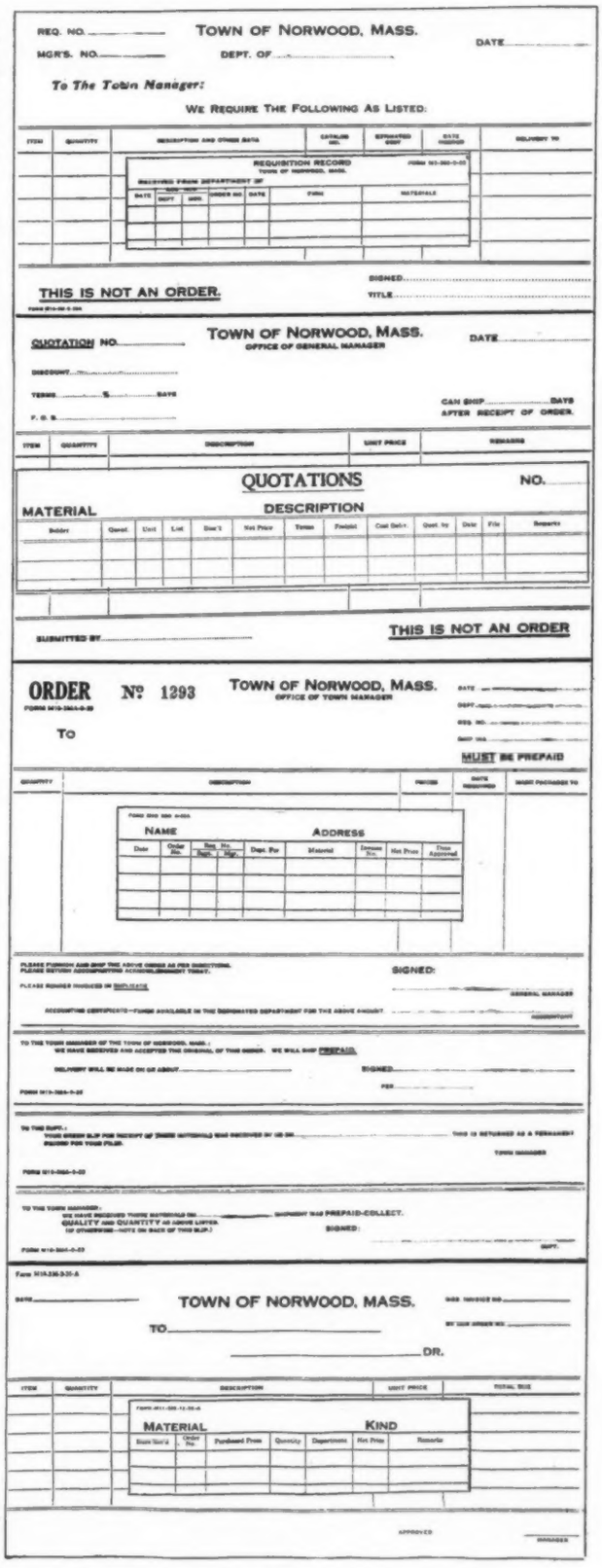
The fifth form is the order. Before mailing this order, it is taken to the town accountant or auditor and the special appropriation against which it was drawn is incumbered to the amount of the order and that money is reserved to meet the invoice when rendered. This of course is the only safe check against overdrafts. Should the invoice come in for a larger amount or if the discount results in a smaller amount, the proper account is adjusted. The second copy is signed by the vendor and immediately returned to the purchasing department giving the date when the goods will be delivered. The third copy is the

form which goes to the superintendent of the requisitioning department immediately upon the placing of the order and gives him full information as to what materials to expect and who is to ship them; as well as when and by what kind of delivery. When the goods are received, they are checked by the department head and this form is signed as to receipt and returned immediately to the purchasing department. In exchange for this, the purchasing department sends the fourth copy of the order (which has been held in the purchasing department files as an unfilled order) back to the requisitioning department, with the date marked as to when their receipt was received. The department files its copy away for future use on further requisitions. The last copy of the order goes to the accountant when he encumbers the original order and is filed by him as information relative to the entry in the appropriation ledger. The card index is filed both by materials and firms, so that a ready cross reference is available at all times.

The final form in the purchasing department is a standard invoice form on which invoices are made out in case a duplicate is not sent by the vendor or for for any other reason another bill is required. In the public works store yard and in the electric light department store yard, a stock clerk is kept on duty at all times and a card for every item of stock is kept up to date with receipts and disbursements as well as items for the minimum and maximum quantity to be kept on hand.

Credit memorandum forms are used when supplies are delivered from one department to another. There are three stock forms of postal cards used, one requesting catalogues and information, another advising the vendor that the goods have not been received on the date promised in his acknowledgment, and the third postal is used to acknowledge the receipt of proposals from unsuccessful bidders. The entire purchasing operation is carried on by one young lady in the manager's office who also has sufficient time for the checking of payrolls of all the departments and the billing of all supplies sold by various departments and many other matters of a secretarial nature in assisting the manager. It might well be claimed that the services of one person would be necessary for all the additional work performed and that in reality the purchasing in Norwood does not cost anything, but in any event there can be very little dissension from the fact that purchasing in Norwood saves the community $20,000 a year (equivalent to $.75 on the tax rate).

Careful checking discloses a total during sixteen years of approximately four million dollars in invoices passing through the manager's office, with a total saving to the taxpayers of over two hundred thousand dollars.



Top: Requisition form: duplicate for department file. Second: Quotation form: duplicate kept by firm making quotation.

Third: Order form: also bottoms of the three duplicates—On each form is shown the filing card on which is kept a record of the procedures effected by means of the forms.

No Untreated Water in These Counties

Niagara, Orleans and Schuyler counties in New York State have no untreated public water supplies.

All of the eight public supplies in Niagara county are both filtered and chlorinated. Five are derived from the Niagara river, two from Lake Ontario, and one from an impounding reservoir on an upland stream. Orleans has four supplies, two being chlorinated, and two filtered and chlorinated; while Schuyler has two, one chlorinated and one filtered.

New Ideas for the Contractor, Road Builder and Dirtmover

Brief descriptions of some of the new equipment designed to lower construction costs.

MUCH new equipment has been developed for use by the road builder and the general contractor. The pages of PUBLIC WORKS during the past few months have contained descriptions of more than a hundred new or improved models of equipment. Herewith are presented some additional recent developments.

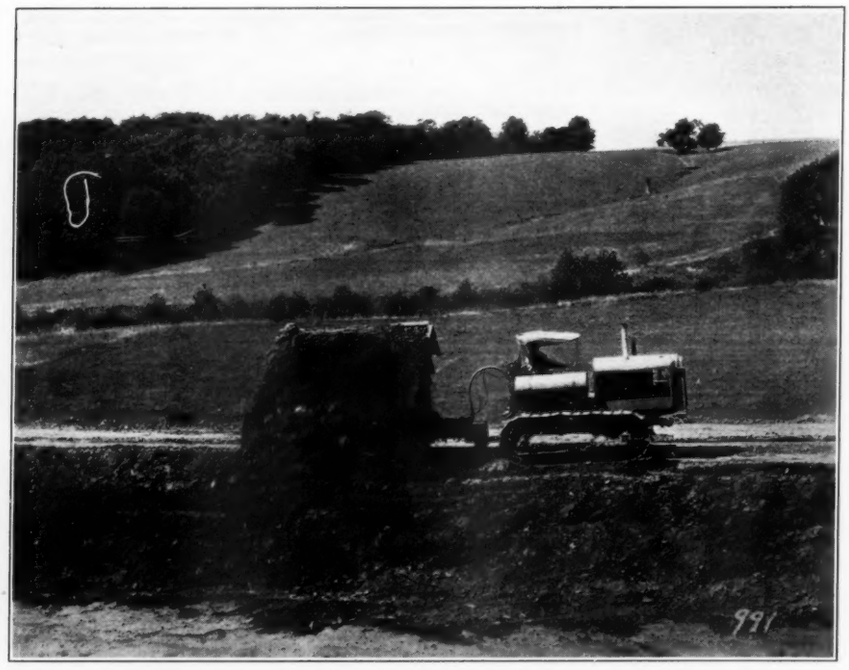
Caterpillar "35" Tractor

The latest development of the Caterpillar Tractor Co. (which this year has announced fifteen new or improved products) is the "Thirty-Five" tractor, which develops a drawbar horsepower of 37. There are four speeds forward—1.7 to 4.6 m.p.h.—and one reverse. In appearance, the new tractor closely resembles the recently announced "50." Deliveries on this machine will begin in the early spring.

Caterpillar has also developed their "Sixty" for oil field and pipe line work. Equipment on this model includes scavenge oil pump, crank case guard, front pull hook, front bumper, radiator guard and engine enclosure hood.

Three-Way Dump Wagon

The La-Plant-Choate 3 way dump wagon has been developed by experienced road equipment engineers to meet the demands of the earth-moving contractor where side or rear dumping is necessary. It dumps to the rear, to the right, or to the left, the dumping position being controlled by a single lever at the front of the wagon. "Roadlayer" tracks are placed directly under the center of the body, thereby putting the weight on the tracks and not on the tongue or drawbar. Being of short coupling type, the LaPlant-Choate DW-8 wagon can be maneuvered in very small cuts. These wagons are furnished only in the 8-yard capacity, and mounted on 15-ton "Roadlayer" tracks.

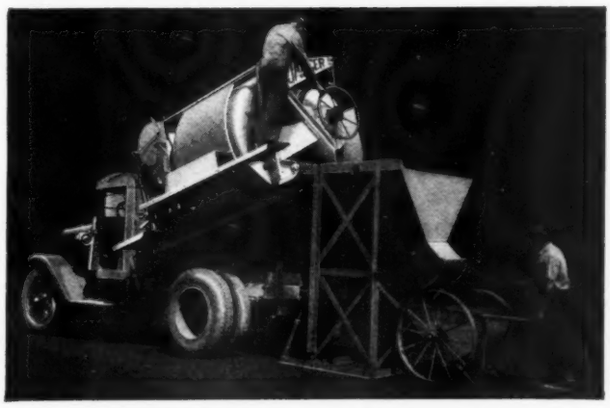


La Plant-Choate 3-Way Dump with Caterpillar Tractor

Jaeger Rear Lift Hoist Attachment

The Jaeger Machine Co., Columbus O., has developed a rear-lift hoist attachment for the 2 and 3-yard Jaeger truck mixers which makes possible an 8-foot total elevation of the discharge end of the mixer. The spouting area over which concrete may be chuted is increased by 75% making it possible to cover alleys, road shoulders, and some streets to their full width; sidewalks and inside residence parkways can be poured from the street; foundations or other forms can be reached from distances inaccessible to the ordinary truck mixer; and, with drum lifted, it is possible to discharge direct into storage hoppers for wheeling to points that cannot be reached by truck. At maximum tilt the positive discharge action of the Jaeger Spiral Mixing Blades insures clean, rapid discharge; 2½ yards of 1″ slump concrete being discharged in 3 minutes and 2½ yards of 5″-6″ slump concrete in 1 minute, 30 seconds.

The hoist mechanism is manufactured by The Wood Hydraulic Hoist & Body Co. The attachment can readily be mounted on any standard type of truck which is equipped with power take-off to drive the hoisting mechanism. Jaeger Truck Mixers or Agitators can be equipped with rear-lift hoist attachment either at the factory or in the field. Hoist frame alone adds 15″ to usual discharge height with body down; with body tilted to maximum it increases this height an additional 30 inches (45 inches total). This hoist eliminates all possibility of body sway.



The Jaeger Truck Mixer with hoist attachment

Bucyrus Erie Balanced Hoist

New Balanced Hoist for Stripping Shovel

A new feature in shovel design, announced after more than a year's experience in the field with several installations, is the Bucyrus-Erie balanced hoist for stripping shovels which increases the dipper size and the operating speed of the shovel. Its essential parts are a movable counterweight with the necessary guides and tackle, so arranged that, as the dipper goes up through the bank in its digging motion, the movable counterweight travels downward in its guides, counterbalancing practically all of the weight of the dipper and increasing the amount of digging force available. As the dipper is returned for the beginning of its next cycle, the counterweight is raised in its guides so that it is again ready to counterbalance the dipper on its way up through the bank. Thus, during the hoisting cycle, practically all power of the hoist motors is spent in actual digging, because the dipper's weight is counter balanced by the descending counterweight.

Ditcher Mounted on Pneumatic Tires

A new development in small ditchers is the Parsons Model 14, designed to meet the needs of contractors and public utilities in laying small pipe lines, gas and water mains, house connections and conduits. Mounted on pneumatic tires, the Parsons 14 travels to the job under its own power, and is ready for digging as soon as it is on the job. In a metropolitan area, several small jobs may be handled in one day.

The machine is only 7′ 3″ high and 6′ 9″ wide, including conveyor. It will cut a trench 6″, 9″ or 12″ wide and 4′ 6″ deep. There are 20 digging speeds, forward and reverse, the highest speed being 16′ per minute. Road traction is obtained in four different speeds ranging up to 6.4 miles per hour. In one case the Model 14 traveled over 80 miles in 14 hours.

Another development for digging efficiency is a front-discharge self-cleaning bucket. For digging trenches from 6 to 12 inches wide, this bucket has proved to be particularly advantageous. The buckets are cast integral with the chain and are not attached to separate chains, as is done on the larger machines. The power plant consists of a McCormick-Deering Industrial Tractor unit.

New Austin Badger Shovel

The new Austin Badger is an 11-foot capacity shovel which is readily convertible to a clam shell bucket, back-filler, trench hoe, drag line or handy crane.

It has full swing of 270 degrees, giving ample range of movement for both digging and dumping. The crawlers are so geared and controlled independently, that the shovel can turn in its own length and be placed in the most favorable operating position very easily. By virtue of the specially constructed curved boom, of improved design and better balance, coupled with longer dipper handles, the bucket has an exceptionally high lift. It is powered with a McCormick-Deering Model 20 Industrial unit and can travel as high as 4 miles per hour, though when traveling any considerable distance a heavy rubber-tired portable truck is used.

The full power of the motor is made available for operation of the dipper through the "power take-off" in the transmission, which operates through gearing all enclosed and running in oil.

(Continued on Page 74)

The Parsons Model 14 Ditcher is mounted on pneumatic tires

San Francisco's Unemployment Relief

At a special election on February 6th, 1931, the voters of San Francisco authorized the issuance of two and a half million dollars of bonds for unemployment relief through public work, of which $1,400,000 was to be spent in improving paths and roads in public parks and squares, $900,000 for constructing roads and highways, and $200,000 for improvements in public playgrounds.

Prior to sale of bonds the city advanced sufficient money to begin the work. The bonds sold at a substantial premium. For some time a registration of unemployed citizens had taken place in the city hall and it was the aim to employ only these men for two weeks continuously at a rate of $4.50 per day for common labor, then to replace them with another contingent, in other words to rotate labor.

The labor was very inefficient, but fairly satisfactory progress was made in several of the projects outlined. The funds were exhausted and the work discontinued on most of the jobs on July 3rd.

Bernal Heights boulevard was probably the most striking of these jobs, The boulevard encircles Bernal Heights, giving a roadway of approximately 5000 ft. length. The entire hill is rock and the roadway is made largely in cut in cherts and sandstone with deep rock slopes. There are two 7 ft. sidewalks and a 36 ft. roadway. The grading was done largely by hand labor, although in the heavier cuts use was made of a steam shovel and several motor trucks.

In extending Clarendon avenue for 3940 feet, more than a thousand eucalyptus trees about 65 years old were removed and cut into 4-foot lengths, split and piled for use of the water department and the Laguna Honda Home. In this street there were laid 1300 feet of 12-inch vitrified clay sewer and 900 feet of 12-inch cast iron pipe sewer near a reservoir; also the necessary catch basins, culverts and manholes.

Also 680 eucalyptus trees were cut, split and piled in building about half a mile of Lake Merced boulevard. Here a 60-foot roadway was paved with 10 inches of waterbound macadam, on which an asphaltic top will be laid ultimately.

Miscellaneous jobs done for unemployment relief included: Placing 1700 lineal feet of 6-inch tile drain in a four foot trench which was back-filled with crushed rock. On a number of boulevards guard fences were repaired, slopes redressed, stairways cleaned, gutters re-established. In one district four miles of streets were cleared of sand which had drifted over them and protected by planting 750 acres of sand hills to barley and wire grass. About 400,000 cu. yd. of sand was removed by hand labor and small trucks.

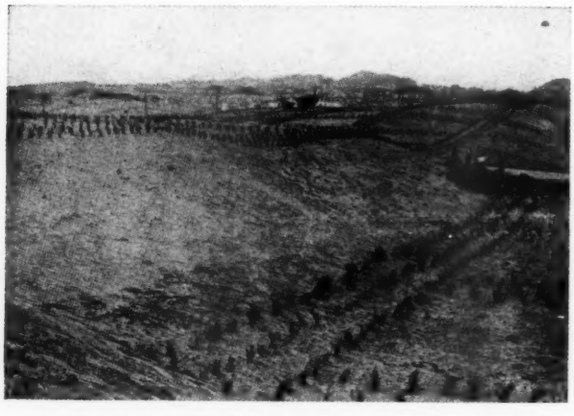
Labor Used in Street Repairs

Repairing streets is one of the methods of relieving unemployment suggested by a number of engineers. It is interesting, therefore, to learn what percentage of the cost of repairs goes directly to local labor. The following figures are from the report of the street maintenance division of the city of Baltimore for the year 1930. It should be noted that there was no effort at this time to use as much labor as possible, and where this is the aim the labor percentage could probably be made higher without very considerably increasing the cost. Sheet asphalt repairs are not included as these were let by contract.

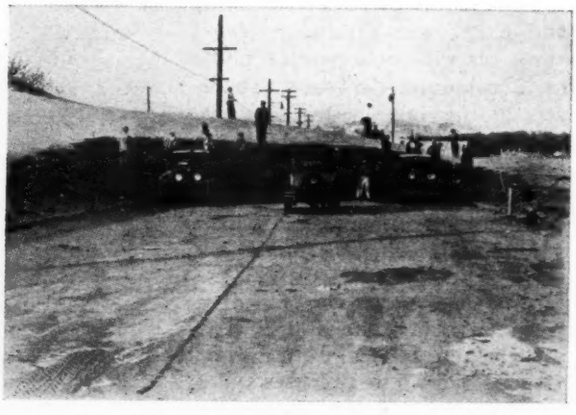
Of the total of $684,109 spent for labor and materials for this work, 65% was for labor. Comparing the average unit costs per square yard for labor and for materials, respectively, for repairing the different kinds of pavement we find that labor received the following percentages of the total: Grading, 100% cutting out concrete curbs, 100%; cobble roads, 90%; cobble gutters, 85%; asphalt block pavement, 84%; granite block pavement, 71%; vitrified brick pavement, 70%; brick sidewalks, 70%; 6-in. concrete base, 68%; bituminous macadam, 55%; concrete curb, 50%; concrete surface, 47%; cold patching, 47%; cement sidewalks, 41%.

New Softening Plant Saves Soap

The water purification and softening plant recently constructed by Neodesha, Kans., has been in operation for several months. Very satisfactory operating results are being obtained. The total hardness of the tap water is being maintained at about 70 p. p. m. Tests have been conducted to determine the actual savings in soap to the average family due to the softer water. Accurate records were kept by several families of the amount of soap used for several months before the plant was completed. These records have been compared with the amount of soap required under the same conditions since the plant has been in service. The saving has been found to exceed the contemplated increase in water rates.

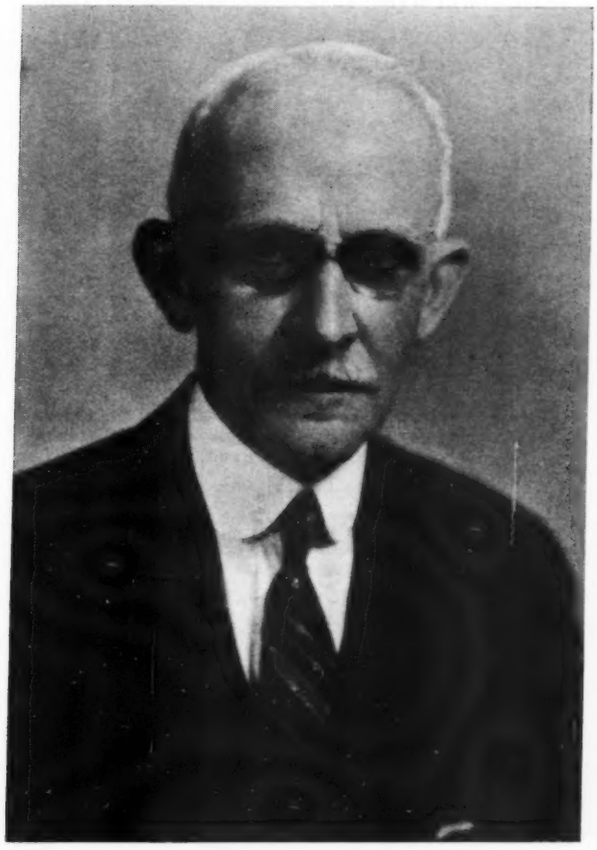


Sand dunes planted to wire grass to prevent drifting.



Removing sand drifted onto a paved street.

THE EDITOR'S PAGE



A. PRESCOTT FOLWELL

Who has served the readers of PUBLIC WORKS *as Editor for 25 years*

ONE of the leading municipal engineers of the United States; known and quoted wherever engineers gather; author of "best sellers" in engineering text-books; widely acquainted among the engineers of the country; ideally fitted to give engineers, young or old, help and counsel in the many problems that confront them. The staff of PUBLIC WORKS offer their congratulations on the completion of these first 25 years—and may the forthcoming years be as helpful, as fruitful, and as useful!

A heavy wheel, pulled by the finishing machine, cuts a groove in the center of the pavement.

The bottom half of the bulkhead used in making poured expansion joints is of sheet metal; the top is wood.

After finishing, the T bars are removed, leaving a joint which, when filled with bitumen, becomes a traffic line.

Minnesota's Combined Traffic Line and Expansion Joint

By Wm. E. Barker

AFTER trying several kinds of center joint, the Minnesota Highway Department is now specifying a combination dummy joint and traffic line.

The joint is made by forcing a built-up "T" bar into the concrete. The stem of the "T" forms the dummy joint while the table makes a slight depression in the concrete, 2¼ inches wide. When the joint and depression have been filled with bituminous material, a black traffic line is formed, both straighter and neater than those that are painted on the surface, and anchored to the slab by the dummy joint. It is expected that the bituminous material will not have to be renewed as often as the painted traffic line.

In constructing the combination joint and traffic line, a groove is first cut in the freshly poured concrete by a wheel pulled behind the finishing machine. At first this wheel was attached to the finisher itself but it was found that the slight transverse motion of the finisher, due to the motion of the screed, made an uneven joint. So now the wheel is mounted on a frame which is supported by four wheels that run on the forms and is pulled by the finishing machine. A control rod extending to the finishing machine allows the finishing machine operator to raise the wheel or lower it to its cutting position.

After the groove has been cut, the T-bar is put in place. The groove is not as deep as the length of the web of the T-bar because it has been found best to tamp the bar into place, one or two light blows being sufficient. The T-bars are installed from a bridge supported on the forms.

After the T-bars have been installed, the pavement is scraped with a straight-edge to remove any laitance, checked for inequalities, and belted. After the final finishing operation, the T-bars are removed, leaving the joint ready to be filled with asphalt.

One man installs and removes the T-bar. During the past construction season the average wage for this work was 70 cents an hour and the average run 100 feet an hour. The man on the finishing machine operates the cutting wheel as part of his other duties, so there is no labor charge for making the groove. A hundred feet of joint requires about 6 gallons of asphalt costing approximately 75 cents, and the labor of pouring costs approximately 50 cents per hundred feet. The cost of equipment is negligible. The total cost of the joint and traffic line is, then, about 2 cents per lineal foot.

Minnesota also uses a transverse expansion joint which is different from those specified by most highway departments. The contractor is allowed to build either the premolded or poured expansion joint. When the poured joint is put in, a special bulkhead is required so that it can be removed without disturbing the dowels. The lower half of the bulkhead is sheet metal bent to the shape of a tall U, but having a bellows shaped bottom, so that it will collapse easily. The top half of the bulkhead is wood and fits down into the open end of the metal section. The dowels project through holes cut half in the metal and half in the wooden part of the bulkhead.

The metal is left in the pavement; the wooden portion is removed after the concrete has partly hardened. The entire joint is later filled with hot bitumen.

HIGHWAYS and PAVEMENTS

The windrow of gravel, with machine in distance.

A New Method of Laying Bituminous Road Surfacing

Recently there has been developed a method and mechanism for laying bituminous road paving, all three of which—method, mechanism and road—possess new and interesting features. The method is specially serviceable for improving existing roads by laying two or three inches of bituminous concrete on them. It differs from the customary one chiefly in the fact that the mixing is done on the spot, as in the case of laying a concrete road, and that a mechanical spreading and tamping finisher is employed which does not require side forms to carry it. The method and machine, during their development, have been used on some 36 miles of roads on seven different jobs scattered from Missouri to Northern Wisconsin; in the latter state last fall with the temperature at 45°. In November a mile section of old gravel road near Aurora, Ill., was laid under the direction of E. L. Gates, county superintendent of highways, as a demonstration by the Barber-Greene Company, manufacturer of the equipment used. A description of this will explain this method as finally developed.

The old gravel road was primed with 13-18 viscosity tar about a week in advance, which prime coat dried under traffic. Gravel was used as an aggregate for the new top, and before the paving began this was delivered in a windrow along the center of the road, leaving room for traffic on each side of it. (This gravel must be dry when mixed with the bituminous material, and should it be rained on, is spread out with a blade, dried by sun and wind, and again windrowed.) The gravel was spread in the windrow by a spreader box, the opening of which was adjusted to deliver just the amount needed for the surface, which was to be made 20 feet wide and an average compacted thickness of 2½ inches.

When the pavement was being laid, the mixing machine picked up this windrowed gravel, a spiral feed working it into the buckets of a bucket loader, which in turn discharged it into a storage hopper. The floor of the hopper is an apron conveyor, which carries the gravel through a calibrated gate onto a system of baffles, down which it tumbles into a mixer, being sprayed with asphalt from a series of nozzles while in the baffles. The bituminous material was supplied to the machine hot from a distributor truck, where the temperature was maintained by a heater. The mixer, which was a twin pug mill, discharged the mixed gravel and bitumen into the front of the spreader-tamper unit, where two horizontal spiral

The machine picking up the gravel and converting it into finished pavement in one operation.

ribbon screws distributed it across the entire width of the road. Immediately behind these was a tamper 1½ inches wide and extending the width of the road, which exerted a total pressure of six thousand pounds and acted as a strike-off; and behind this was a screed. An arrangement of evener levers for supporting the tamper on four shoes which are spaced over a 23-foot longitudinal base served to give a finished surface in which any irregularities of the original pavement were greatly diminished.

The entire process of distributing and compacting required only two to four minutes from the time the bitumen and aggregate were combined, and therefore bituminous materials could be used which set up more quickly than those usually employed where long hauls from mixer to job are necessary, or there are other delays in its use.

Settling Highway Fill in a California Marsh

A section of the Redwood Highway in California includes fills across an arm of Richardson bay, which were made largely on marsh and tide lands. Fills across marshes are usually sunk as far into the mud as the heavy equipment with which they are constructed will sink them. During construction they are brought to grade many times, only to have huge slices or sections to the fill shear off and drop several feet into the mud, displacing it and causing an upheaval on the sides. Finally a state of apparent floating stability is reached, but on opening the road to the pounding of heavy traffic it commences a slow subsidence of only a few inches per year but steady and relentless over a long period of time. The railroads brought their tracks to grade by adding ballast but the remedy for a highway is not so simple.

The settlement of a fill is never exactly uniform. This in itself tends, by removing the support underneath and distorting the mass, to disintegrate the wearing surface.

It causes depressions which, even if slight, prevent surface drainage due to the wide roadway and the light crown allowable. These depressions cause puddles and splashing during wet weather and tend to further disintegrate the surface by water seeping through.

Until the subsidence has continued over a period of several years, and the road has been repeatedly patched and smoothed up, it is not advisable to invest in a permanent or heavy type of pavement.

On this project across the arm of the bay, between De Silva Island and the mainland, the mud was sounded to a depth of fifty feet prior to construction.

During construction with the usual methods the mud was heaved several hundred feet outward on either side of the road grade and it was apparent that the problem of subsidence was to be particularly acute.

Tons of 60 per cent nitroglycerin gelatin were used in blasting the mud from beneath the heavier fill material, settling it after several blasts to the hard bottom beneath. The fill was sounded after each blast to determine the effect of the shot.

The full value of this experiment will not be known until all the data have been compiled and analyzed, which includes the sounding of displaced material on the sides as well as that within the roadway section. But it is definitely known that a fill can be forced down to bottom even with the great depth of mud here encountered. It is hoped to determine from the data obtained on this project just what is the maximum depth to which a fill can be economically forced to produce final stability.

It is known that a portion of the roadway material was displaced with the mud and lost for roadway purposes. The amount of this should be determined from analysis of side borings.

How to Make Your Shovel, Crane or Dragline Last Longer

By G. H. Olson, Link-Belt Company, Chicago, Illinois

IN the operation of a shovel-crane-dragline powered by an internal combustion engine, there are five things which will materially prolong the life of the machine, increase its efficiency and reduce its maintenance cost. They are simple things, which every operator should know, but many fail to carry out in the every day routine of running a machine.

Cut the following suggestions from this magazine and paste them inside the cab of your machine. Carry out a definite maintenance schedule, and watch the increased service and profits you will get from your equipment.

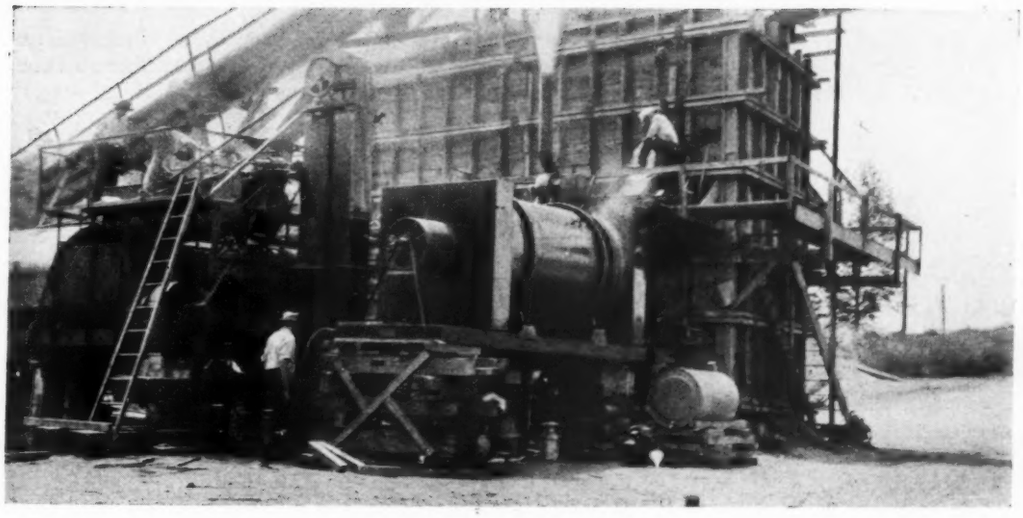
1. *CLEANLINESS.* Keep your machine and its parts clean and well painted. It will inspire pride in your machine and make it easier to care for.

2. *GOOD FUEL.* Use good fuel and keep it perfectly clean. It will increase the life of the engine and give a more dependable power plant for your work. Do not permit your fuel to be stored or handled in any way that is liable to introduce water, dirt or other foreign matter.

3. *LUBRICATION.* Lubricate the machine properly, using the correct grade and kind of lubricant for each requirement. Lubricate often enough and carefully, but at the same time wipe off any excess oil or grease, as otherwise dirt will cling to it, creating an unkempt machine. Depending upon the amount of service the machine is called upon to perform, regulate the lubrication periods, but don't try to stretch the intervals by putting on twice as much grease or oil at a time. If you don't have a lubrication chart, write to the manufacturer of the machine for one.

4. *MISHANDLING.* Exercise care in handling the machine. Don't abuse or break it up by abnormal operation, when a little care will avoid it. In shovel work, don't try to move a whole mountain in one dipperful, but strike the proper combination of cutting depth and height, and maintain it. It will be easier on the operator, easier on the shovel, and more yards of excavation will be moved at the end of the day. In rock, or other very hard excavating, use powder to break it up to such size that the shovel can conveniently handle it. Don't try to save a little powder at the expense of the machine. This will result in greater output, less handling cost, and less strain on the machine and operator.

5. *GENERAL CARE.* Maintain regular habits in caring for your machine. The machine will return the attention manyfold, by not failing you at the most inopportune time, when you are rushed to turn out a certain bit of work. By regular examination of your machine, you will know when a certain part is wearing to a point where it is safest to replace it or have a spare on hand.



Chausse portable asphalt plant operating in gravel pit of J. G. Kemler, near Rochester, Mich. Machine was cribbed up because high water level made it impossible to dig deep ditch for backing trucks under hot asphalt discharge.

Asphaltic Gravel for Low-Cost Streets

By W. McK. White

President, The Chausse Oil Burner Co.

INCREASING interest in low cost road construction has brought forth numerous plans for placing hard wearing surfaces on existing compacted dirt and gravel roads and streets. One of the newer successfully applied types, asphaltic gravel, is being extensively tried out because it appears to offer a finished hard pavement at a cost of about $5,000 per mile.

Asphaltic gravel consists of bank run mineral aggregate, screened to remove stone over ¾-inch, mixed with proper percentage of bitumen. It is laid either hot or cold, depending upon the asphaltic oil employed. Exponents of this type of low-cost pavement consider it more satisfactory than so-called "mixed-in-place" methods. It is mixed in the gravel pit, eliminating haulage of raw material, and involving only the usual transportation of finished mix.

It is claimed that the fresh new gravel gives cleaner aggregate, more evenly divided, assures adequate heat treatment, exact proportioning of asphalt and more uniform mixing, and that it makes a denser and more watertight compacted pavement, which is essential to prevent breaking up under traffic or frost damage in winter.

Macomb County, Michigan, one of the first to try out asphaltic gravel under the direction of County Engineer McKinney, has successfully and economically surfaced a large mileage of county highways. This county has several gravel pits from which local materials can be secured.

Recently approximately 50,000 sq. yds. of this material was placed on the streets of the village of Rochester, Michigan. Most of these streets were of gravel over a natural earth base, the gravel having become solidly compacted by traffic.

A contract was let at first for only about two miles of surfacing but as the work progressed the village officials were so well satisfied that they increased the contract to cover approximately 50,000 sq. yds.

Gravel was obtained from the pit of John G. Kemler, 3 miles from the town. No special processing was necessary. Carried by belt conveyor from the bank to the top of the bins, it passed through screens to exclude stone over ¾-inch but it was not washed. It contained normal moisture, not over 8%, and was fed directly into the contractor's heating and mixing portable plant. Kemler's sub-contract included hauling the hot mix in steel-body dump trucks, 3 miles to Rochester. These bodies were kept oiled to prevent sticking, and the loads covered with canvas en route to retain heat.

A feature of the contractor's equipment was a premixing portable asphalt plant, which is shown in the accompanying illustrations. This was made by the Chausse Oil Burner Company of Elkhart, Indiana. It consists of two units, both mounted on steel wheels with solid rubber tires, thus being readily movable. The photographs show the machine cribbed up, which was necessary because the high water level in the pit prevented digging a deeper run-way for loading trucks. This plant can be used in making standard formula asphalt paving mixes, using crushed rock and sand, either for hot or cold laying. It is equipped with two Hercules engines, oil burners, American exhaust blower, and small Worthington air compressor.

One unit is the drier. Aggregate from the pit bin feeds directly into a large hopper from which it passes into the rotating sand drier, where it is thoroughly dried, heated to about 300°F. and discharged into an elevator attached to the other unit.

The elevator raises the heated aggregate and discharges it into a self-measuring device, whence it passes into a continuous blade type pug mixer. At the same time, bitumen or asphalt, which is being heated in the 950-gallon tank, is pumped into a measuring device connected to the aggregate measure. The asphalt measuring device is adjustable so that any amount of bitumen up to 10% can be admitted into the pug mixer. For the Rochester job about 5% to 6% bitumen was used. From the pug mill, the hot

stuff dropped into the storage bin which has a movable bottom gate operated by the truck driver.

The force used by the contractor on this job consisted of

1 Foreman
2 Plant operators
4 Shovelers and rakers
1 Man setting forms, etc.
1 Roller operator
1 Driver with truck to haul asphalt to plant
1 Fireman for tank car heater
2 Watchmen

In addition, Kemler normally employed three or four men driving trucks and one or two on the gravel supply.

The total operating cost was about $4.00 per ton, completely laid and rolled. This includes all material and labor, interest and depreciation on equipment. It further figures, with ample margins, a cost of roadway complete at about $1,500 per mile per inch compacted thickness, 20 ft. wide. On this job, a 3-inch thickness of loose material was placed, which compacted to 2½ inches when rolled.

The method of installing the asphalt plant in the gravel pit next to the gravel bins worked out admirably as the only hauling was of the finished product to the points of application. The haul of 3 miles showed practically no loss of heat and it is thought that a haul of 15 to 18 miles is entirely feasible. The material was laid at an average temperature of 275° F.

About half a day is needed to make the plant ready for hauling to any other location and in about a day it is ready for complete operation. This easy mobility is a feature of value to gravel producers, especially those with several pits. It enables them to handle low cost road work on county and state highways as well as in municipalities, and to reopen the market for gravel which has become somewhat lessened by the decreased new mileage of higher cost roads.

Street and highway officials, contractors or gravel producers desiring further information concerning asphaltic gravel and its applications can secure it by writing to the manufacturers of the equipment, the Chausse Oil Burner Company, Elkhart, Indiana. This type of material does not require any patented ingredients.

Snow Removal Practice in Several Cities

THE International Association of Public Works Officials at its recent convention held a symposium on snow removal, at which a number of city officials described their methods. Some of the more interesting features of these descriptions are abstracted in the following paragraphs.

A. E. Roche, commissioner of public works of Troy, N. Y. described how he removed a 7-inch snow storm at one cent a cubic yard. Most of the streets contain car tracks, and here they plow to the curb; on other streets they plow to the center. Mechanical loaders load the snow into department trucks, which haul it to the river and dump it there—an average haul of 2,000 feet from the commercial center. Work is usually started at 6 or 7 in the evening, and by 6 or 7 the next morning an ordinary 7 or 8-inch snow fall will be removed from the congested district, covering 18,000 to 20,000 lineal feet of roadway having an average width of 38 feet.

In this work the department uses its own foremen, the regular department laborers, and its own trucks. A rental charge for the trucks is allocated to the work, and the regular wages for foremen and labor—75 cts. and 50 cts. per hour respectively and 62½ cts. for chauffeurs.

Wm. J. Galligan, assistant superintendent, Bureau of Streets, Chicago, said he believed Chicago used the first Barber-Greene mechanical loader that was made, and has effected a considerable saving by its use.

Henry D. Dolge, assistant superintendent, Bureau of Sanitation, Milwaukee, stated that his city about 9 or 10 o'clock in the evening starts operating 46 plows attached to tractor-type Sterling trucks. In fifteen down-town districts two trucks each are used, and one truck for each of the sixteen outer districts. In the downtown section, about two square miles, all streets have been plowed to the curb by eight the next morning. After six in the morning the foremen of the different wards hire all the men they need, without reference or preference, to load the snow into tractors and trailers, which haul it to the river. Thus the downtown district is practically cleaned up the first day after a storm.

James Garberg, superintendent of streets, describing the Minneapolis method, said they used approximately 35 trucks equipped with plows, first attacking the primary streets, all of which are plowed in about four hours. Then the patrol graders or big, heavy tractors are used with a straight edge in an attempt to clean the snow down to the pavement. Then the snow is removed. The city has three mechanical loaders, the use of which depends on the character of the storm. All the equipment is owned by a central equipment department, to which the snow removal service pays from $2.25 to $2.75 per hour for a 3½-ton to 5-ton truck, $5 for a tractor equipped with plow, etc. Labor receives $5.50 for an 8-hour day, mechanics 95 cents an hour, truck drivers 75 to 80 cents.

Wilbur H. Winship, street commissioner of Indianapolis, started a discussion on methods of remedying slippery pavements by saying that he had used a lime spreader (a farming implement) attached to the rear of a truck for spreading a mixture of sand and salt over the roadway, the apparatus throwing it about 40 feet. This is used at once as soon as sleet begins to form. One truck, with a driver and a man to keep the hopper filled with the sand and salt, covers about 8 miles of street an hour.

Edwin A. Miller, supervisor of maintenance, Rochester, N. Y., said that his city uses calcium chloride and sand, one of the former to five of the latter, spread by means of mechanical spreaders, and has practically eliminated accidents from sleety pavement.

Mr. Galligan said that Chicago used salt and sand for several years, but had substituted calcium chloride for salt, which corrodes bridge machinery and other metal.

Montclair, N. J., said A. P. Heyer, director of public works, has been using calcium chloride for three years, mixing it with dry cinders at the yard and distributing it from trucks.

Road Construction Above the Timber Line

Colt & Son working a Thew shovel in Fall River pass last June.

By Jos. C. Coyle

FAR above timber line in Colorado, men and machines are making it easier for the motorist to reach the forests and natural wonders of Rocky Mountain National Park. Effort is made to preserve the natural beauties of the route traversed, and the many box culverts of reinforced concrete which are installed to drain away the run-off from winter snows, have head and wing walls built of rubble masonry, and any retaining walls which are necessary are built of the same material. However, for culverts up to 30 inches diameter on hillsides, where they are usually necessary about every 700 ft., corrugated iron pipe is used.

Among the more interesting of these road projects is the building of the Fall River road in the Rocky Mountain National Park, for the National Park Service. The work is practically all on new location, at an altitude ranging from 8,000 to 11,000 ft. above sea level. Most of the roadway now under construction, which is not less than 24 ft. wide, will probably be surfaced in 1932, using a 5-in. base coat, followed the next year by some form of bituminous top. Natural surfacing stone procured along the road is deemed very satisfactory in the meanwhile.

The contract for section 1-B was let to W. A. Colt & Son, in the fall of 1929, and work has been continued through the short working seasons of 1930 and 1931. It involves the excavation of 354,000 cu. yd., about one-third of which is rock. The project extends a distance of 17.2 miles from the top of Fall River pass toward Estes Park to Deer Ridge, where it intersects the High Drive road.

Five Thew shovels were used by Colt, three 1½-yd., one 1-yd., and one ⅝-yd. A "Thirty" and a "Twenty" Caterpillar tractor were used, also three road graders of different makes. One hundred to 120 men and about 20 Ford dump trucks were on the job. Three Gardner-Denver and two Ingersoll-Rand portable compressors, with several Gardner-Denver jackhammers were used in drilling.

Section 1-C, 11 miles long and involving the excavation of 316,000 cu. yds., approximately 40 per cent of which is rock, was started by L. T. Lawler, of Butte, Montana, contractor, in the fall of 1930, continuing through the working season of 1931. It extends from the top of Fall River pass to the Colorado river, the altitude ranging from 11,800 ft. in the pass to 9,000 ft. at the river. These two projects will be finished in 1932, at a total cost of approximately half a million dollars.

Extremely heavy work was involved on this project, as well as some very wet ground along the shore of Poudre Lakes, between Milner and Fall River passes. At the latter point it became necessary to erect a cement rubble wall for a distance of 500 ft. and to a height of 12 to 16 ft. in order to preserve the natural shore lines of the lake. The upper cut slopes were flattened to a 1 to 1 slope to avoid the use of rubble walls in holding them.

Lawler used a 1¼ and 1-yd. Thew shovel and two P & H 1¼-yd. shovels; three Ingersoll-Rand and three Gardner-Denver portable compressors, and several jackhammers and one Ingersoll-Rand drill sharpener. From 120 to 200 men were employed and the shovels worked double shifts to speed up the work.

On both jobs the percentage of cast-over work was small, practically all excavated material being hauled. Frozen ground at the high altitudes often necessitated the moving of the shovels back and forth on a section of the road, taking off three or four feet of the surface as the sun thawed it out.

A. E. Palen is district engineer of district No. 3. His assistant in charge of forest and park work is C. E. Learned. W. L. Lafferty is resident engineer and Robert Coffey assistant on the Fall River work. Edmund Rodgers is superintendent of the Rocky Mountain National Park.

Experimental Concrete Paving in Kentucky

By D. C. Brooks

Secretary, Kentucky Association of Highway Contractors

ALTHOUGH many thousand miles of concrete roads have been built in the United States during the past twenty-five years, there is no agreement among engineers as to the spacing of transverse joints or even as to the use of them, or concerning use of reinforcement. Different cities and states employ different methods of curing, such as dirt or straw covering, water ponding, calcium chloride, silicate of soda, spraying with bituminous material, etc. While local conditions may properly affect the choice of curing methods, there seems to be little excuse for the fact that curing methods adopted in one state are absolutely prohibited in another.

Kentucky, a number of years ago, constructed some concrete pavement using wire mesh reinforcing and expansion joints, but of recent years has built almost entirely the so-called Illinois type, using longitudinal metal strips to divide the pavement into two slabs, with no transverse expansion joints.

This year, however, some experimental work is being undertaken on a contract on the Louisville-Cincinnati road awarded to Gorrell, Barrow & Kirkpatrick of Russellville, Kentucky. The entire contract involves the paving of 10.352 miles of this road, and 5.728 miles will be constructed as the reg-

ular Illinois type with metal center strip, ¾-inch smooth, round, longitudinal bars placed 4 inches from the outside edges and 4¼ inches below the pavement surface. Half-inch round, reinforcing bars 4 feet long are placed through the metal center strip at 5-foot intervals. No other reinforcing will be used on this section. The curing will be done with either dirt or straw covering kept wet 7 days and left on the pavement for 14 days. In this method of curing, the dirt covering to a depth of 2 inches or straw covering to a depth of 4 inches is applied not later than 10 A. M. of the day following the day in which the concrete is poured. Initial protection is provided by covering the pavement surface with 10 or 12-ounce burlap as soon as the concrete has set sufficiently to prevent marring the surface. The burlap is immediately wetted and kept wet during the day for a period of not less than 3 hours after it has been placed on the concrete poured just before night. The ponding method of curing, by ponding the water on the surface by earth dikes or dams may also be used, the choice of earth covering, straw covering, or water ponding methods being left to the contractor. Both the dirt and straw covering methods are popular with contractors in this state but the water ponding method is rarely, if ever, used.

Next to this section comes a section 2 miles in length called section 1-A and 1-B which is being constructed of the same typical cross section of concrete but the metal center strip is replaced by a bituminous premoulded longitudinal joint. This joint is 2½ inches deep, ⅜ of an inch wide, and is filled with premoulded asphaltic mastic filler. This section will have transverse contraction joints at 40-foot intervals, these joints also being 2½ inches deep, ⅜ of an inch wide and filled with premoulded asphaltic mastic filler. The edges of both longitudinal and transverse joints are edged with an edging tool of ¼ inch radius. This section will also have the ¾-inch round, plain bars placed through the center joint as in section one. Three-quarter inch plain round bars 4 feet long will be placed through each transverse joint 6 inches from and parallel to the center joint on either side. The difference between section 1 and section 1-A and 1-B, as will be seen, is that the metal center strip in section 1 is replaced in section 1-A and 1-B with the premoulded asphaltic joint and transverse contraction joints are used.

Sections 1-A and 1-B are one mile in length and different curing methods will be used on these two sections. Section 1-A will be cured in the same manner as section 1. The curing of section 1-B will be done as follows: "As soon as the pavement has been finished it shall be protected by covering with 10 or 12 ounce burlap which shall be wetted before being placed thereon. The burlap shall be kept wet by sprinkling throughout the first day until at least 7 P. M. and as much later as may be required to obtain a minimum of 3 hours sprinkling on the last concrete poured this day. Sprinkling shall be resumed at 6 A. M. the following morning and continue throughout the second day until 7 P. M. Sprinkling may be interrupted long enough to permit of straight edging the pavement as provided in Sec. 12.10374 of the 1930 specifications; however, the pavement must be damp when the burlap is removed for straight edging and kept reasonably damp until the burlap is replaced. Burlap shall be removed in sections not exceeding 50 feet to permit of straight edging and shall be replaced as soon as this operation is complete. No further curing will be required after 7 P. M. of the day following that on which the concrete was poured."

Next to this section comes sections 2-A and 2-B, each 1 mile in length. These sections are to be constructed of the same typical cross section of concrete as the other sections and will have the same dowel bars, transverse and longitudinal joints, etc. In fact, these sections will be identical with sections 1-A and 1-B but will have in addition wire mesh reinforcing placed 2 inches below the surface of pavement and the ½-inch reinforcing bars across the center joint will be omitted. The wire mesh reinforcing is to have a total weight of 51 pounds per 100 sq. ft. or 4.59 pounds per sq. yd., not including lap. The wire mesh is of typical design to that commonly used in such paving work. Section 2-A will be cured in the same manner as section 1-B and section 2-B will be cured in the same manner as section 1-A.

It is hoped by the highway department engineers that they will gain considerable knowledge of the relative values of the different curing methods and the different paving designs from a study of these different sections under traffic and weathering. The costs of the different sections are known, as separate bids on each section gave this exact.

Separate bids were taken on the concrete paving on each of these sections, the bid price including all reinforcing and everything connected with the finished pavement except the subgrading, shouldering, etc., which are paid for as separate items. The prices of the low bidder, Gorrell, Barrow & Kirkpatrick, and the other bidders on the various sections are as follows:

BIDDERS	BID PRICE PER SQ. YD. Sec. 1 Regular Illinois Type-Dirt Curing	Sec. 1-A Longitudinal & Transverse Joints Dirt Curing	Sec. 1-B Longitudinal & Transverse Joints Burlap Curing	Sec. 2-A Joints & Wire Mesh. Reinf. Burlap Curing	Sec. 2-B Joints & Wire Mesh Reinf. Dirt Curing
Gorrell, Barrow & Kirkpatrick, Russellville, Kentucky	1.44	1.46	1.46	1.62	1.62
Wilmore Paving Co., Wilmore, Ohio	1.47	1.47	1.47	1.65	1.65
Louis des Cognets, Lexington, Kentucky	1.52	1.54	1.52	1.63	1.65
Ellis, Kelly & Co., Owensboro, Kentucky	1.62	1.62	1.62	1.78	1.78
Newell & Smith, Defiance, Ohio	1.70	1.70	1.70	1.92	1.92
Sipple & Byers, Winchester, Kentucky	1.72	1.74	1.74	1.92	1.92
Carey-Reed Co., Lexington, Kentucky	1.75	1.78	1.78	1.95	1.95
D. A. V. Construction Co., Franklin, Indiana	1.79	1.93	1.93	2.09	2.09
Average of All Bids	1.626	1.655	1.652	1.82	1.822

It will be seen from the average of all bids that replacing the metal center strip of the Illinois type with the premoulded center joint and adding the transverse expansion joints cost an additional 3c per sq. yd. on section 1-A. However, the low bidder made only 2c difference in his bid and several bidders made no difference at all. The addition of the wire mesh reinforcing increased the cost per sq. yd. 16c on the low bid and 17c on the average of all bids. The different methods of curing specified apparently made no difference in cost.

Designing Bridge Substructures

A competition was arranged by a committee of the Public Works, Roads and Transport Congress, held recently in England, in which three papers submitted by Haddon C. Adams, assistant engineer, Roads Dept., Bridge Section, Ministry of Transport, were jointly awarded first prize of a gold medal and one hundred guineas (about $500). One of these papers was a quite complete exposition of the designing of substructures for ordinary highway bridges. While much of it was of course elementary, many ideas were presented that are not found in the text books, drawn, the author said, "mainly from his own observation, deductions and notes accumulated of the past ten or eleven years." An abstract of the authors' treatment of one phase of the design —abutment foundations—is given below as offering some excellent suggestions, as valuable in the United States as in England.

IF DOUBT is felt about the capacity of the ground to bear a reasonable and safe working load at a moderate depth, test pits should be arranged. Useful indication of what resistance is to be met with may be got by the use of a probing bar. Screw-couplings may be used to add on 4-ft. or 5-ft. lengths. In this manner depths up to about 30 ft. have been reached. Tests of this sort are useful if rock is to be met within the limits of probing; the bar will stop suddenly and the hammer will rebound. A judicious selection of probe points will indicate if the resistance is rock or boulder.

The best and surest method, however, of obtaining reliable information about the bearing capacity (assuming rock is not indicated) is undoubtedly that of opening up the ground by test-pits, and following on with loading tests. This may well be done in conjunction with the taking of borings. Tests are sometimes made over an area of 1 sq. ft., but this is not to be recommended. The greater the area under test, the more truly representative is the result. An area of 4 sq. ft. is reasonable, either circular or square in shape. The object of the test is to relate load and settlement. All soils are compressible, and will generally yield up to a certain stage fairly elastically; loading beyond this stage will produce permanent settlement. Some clays will take permanent set from the first.

The test should be conducted as soon after opening up the ground as possible. The hole should be kept free from water, and the surface carefully levelled and a thick, rigid plate properly bedded down, or a concrete slab poured on to the surface; the base of the hole should show no appreciable surface beyond the edge of the plate or slab where squeezing out could take place. Levels should be taken on to points on all edges, directly, or by means of rods which are kept in close contact with the surface. From what he has already observed the engineer will have a fair idea of what safe working load to assume. Careful loading, uniformly distributed over the whole area of the plate, should now be made gradually, but without interruption, up to the full intensity of a fairly conservative assumption for safe load; pig iron or other suitable material may be used. Readings are taken at once, and at intervals over a period of several days until the settlement has ceased. The loading may then be increased by 50 per cent, and similar readings taken. A further and equal increment is made, and the procedure again repeated. The settlements are plotted against bearing pressures, and a curve is obtained. For the first portion of the curve the settlement is approximately proportional to the intensity of bearing pressure; this is the compacting period. Then a sort of "yield point" is reached, and permanent settlement takes place, during displacement, at a more rapid rate. The safe bearing load may be taken at about a half that corresponding to the "yield point" or the point where displacement begins. In the safer type of bridge (*i.e.*, with freely-supported superstructure) two-thirds of this value may be used instead of one-half.

When dealing with clays particular care must be used to afford ample time for settlement. Some clays will safely bear a load for several days and then suddenly yield. Clays will also change considerably with varying water content.

The best foundation bed is level and solid rock. A sloping surface should be levelled or benched, after making certain that there is no danger of cleavage below. A foundation which is only partly on rock is in danger of tilting from unequal settlement. Piles should be used in the area of the foundation bed lying clear of the rock. Firm sand and gravel are both good. When these are found mixed and held firmly as if naturally cemented together (termed "hard-pan") the foundation bed is very good. Firm clays may be quite good, but wet clays are rather apt to be treacherous. Clay is really better when mixed with coarse sand and gravel; it is the presence of a small amount of clay with these materials which provides the cementing medium in hard-pan.

A very complete table of safe bearing values for various soils is given in Scott's book, "Reinforced Concrete Bridges."

Greater bearing value may normally be expected at lower depths where the ground has become more compacted from the weight of material above, and being less liable to variation in moisture content, it is more stable. The cost mounts up with deeper excavation, and there is more water to cope with. The bearing value of the ground should be fixed (unless the tests have to be made later) before the detailing of the footings, so that the selection of a safe loading is not influenced by convenience. The size of the footings must be made to fit the safe bearing pressure, and not *vice versa*.

Concerning construction, he says, in part: "In taking out the excavation the material remaining in place should not be loosened, and if by any chance the excavation is made too deep, the footing level must be restored in mass concrete. No structure should rest on backfill or partly on weak spots of ground.

"The omission of weep holes is a very fruitful source of failure. Wherever possible the ground immediately in front of, or behind, the footing should not be disturbed. Drains if necessarily placed near footing base level should be closed and the water led into them through properly-constructed gullies.

"Where the ground slopes down to the abutment, either naturally or as excavated, this should be benched in a series of level steps as far as possible, so relieving the abutment of load. Slips will sometimes occur from the existence of an inclined slippery layer such as might easily exist in an excavation made in clay; benching will help to prevent this."

RECENT LEGAL DECISIONS

Concerning Matters Connected with Highways and Contracting
By John Simpson

Concrete Paving—Discretion to Contractor—Tests of Cement Used

Specifications for concrete pavements called for one part of Portland cement, two parts of sand and four parts of broken rock or stone by measure, with the proviso that the proportions might be changed by the contractors wherever the voids in the materials used were not filled by use of the ingredients in the specified proportions. The California Supreme Court, Rice v. Hanrahan Co., 293 Pac. 57, held the discretion authorized to the contractor was reasonable, there being nothing to indicate that it would have any bearing on the cost of the work proposed or any appreciable effect upon the assessments.

A clause that the contractor for concrete pavements should, if requested by the engineer, furnish tests of the cement for use to conform to specifications required by the American Association of Civil Engineers, and another requiring Portland Cement for sidewalks and curbs meeting the tests of the standard specifications therefor adopted by the American Society of Testing Materials, did not make the specifications for a street improvement defective. There was nothing to show that the specifications of the organizations mentioned are not commonly accepted as trustworthy standards, and there is no good reason why general trade usages should not enter into public contracts as well as private.

A clause that "any work or material which may have been unintentionally omitted in the description of the work, but which is clearly necessary for proper prosecution of the contract, shall be furnished by the contractor, the same as if it had been specified" was not objectionable, although no arbiter was designated.

Highway Repair Contractor Not Liable for Previous Defects in Highway

The New York Court of Appeals, 256 N. Y. 7, 175 N. E. 353, holds that a contractor, by agreeing with a city to reasphalt a street, and undertaking the work, does not become responsible for every previous defect existing in the highway. The city remains under its obligation to travelers to maintain the streets and highways in a reasonably safe condition, and the contractor shares this duty only to the extent expressed in its contract. Clauses in the contract referring to protecting passageways and placing proper guards around the work refer to the work done by the contractor and to the excavations made and material placed by it in the street; they have no reference to obstructions or dangers created by others or previously existing in the highway before the contractor had reached the place in the progress of its work or had assumed control of the location for repair.

Where the occupant of an automobile truck, which slipped off the edge of a ramp constructed by a street railway company from its raised track to the surface of the old pavement, was thrown to the street, the paving contractor, which had not at the time reached the place of the accident, in its work of regulating and repaving the roadway, was held not liable.

Filing of Assignment of Highway Construction Contract

Section 16 of the New York Lien Law providing that no assignment of a contract for labor or materials for a public improvement shall be void unless filed within ten days after the date of its execution does not refer to the date inserted in the instrument but to the actual date when the assignment was made. Instruments thereafter executed by an assignee of a highway construction contract and delivered to others for the purpose of carrying out the assignment are not new assignments requiring to be filed. Carroll Land Co. v. Jones, Inc., 256 N. Y. 99, 175 N. E. 528.

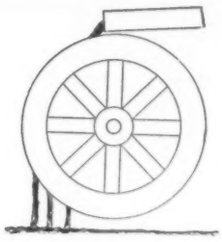
Berms for Base Course Held Included in Contract Price

A contract was made for the quarrying of all the stone for the knapped stone base course of a bituminous macadam surface state road, the fine grading and the construction of the base course to be done to the satisfaction of the road commission. The price was $1 per cubic yard for quarrying the stone and a like sum for constructing the base course, including all work and labor incident to both the quarrying and the construction. In an action by the contractor, he claimed, among other things, for work he alleged was not included in the contract. Under his interpretation he was not obligated to construct the berms (shoulders) which supported the base course. He testified that he did construct berms of from two to three feet in width, upon the promise of the principal contractor to pay therefor. It was shown that berms at least 18 inches in width are necessary to support the base course. The berms were held to be an incident and part of the base course, on the principle: Whatever is necessary to be done in order to accomplish the work specifically set forth in a contract, as agreed to be performed, is parcel of the contract though not specified. Payment for the berms was held included in the $1 per cubic yard.

Mandamus Will Not Lie to Control Exercise of Discretion by Highway Commission

Wisconsin St. 1927, § 84.06, provides: "Contracts for all construction performed under this chapter (for highway construction) shall be between the state and the contractor and payments shall be made from time to time by the state treasurer upon estimates and orders of the commission." The Wisconsin Supreme Court holds, State v. Nemachek, 225 N. W. 170, that this statute clearly implies that the commission shall use judgment and discretion. Its function is not limited to acceptance of the contractors' estimates. The dispute as to contractors' compensation in this case arose over additional work necessitated by certain conditions not anticipated when the contract was entered into. The commission made an estimate of the work, but the contractors sought by mandamus to compel them to issue a "true" estimate. It is held that mandamus will not lie to control the exercise of discretion of an official to pay an unliquidated claim, or where there is an adequate remedy at law. If the duties of the commission in the matter had been merely ministerial, mandamus would lie.

THE WATER WHEEL



By
Jack J. Hinman, Jr.

The essential features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

Design and Plant Construction

ONE of the interesting developments in water works distribution has been the attention given to **elevated tanks** for smoothing out the peaks of water demand in certain sections of our larger cities. Of course the elevated tank has long been employed for this purpose, but with increase in water consumption in portions of the cities which are not provided with mains of adequate size, it becomes increasingly necessary to find a means of maintaining satisfactory service at all hours of the day and night. The elevated tanks furnish a means of delaying the enlargement of mains and pumping machinery installations at the main pumping stations. They may also permit reduction of pumping pressures from those employed during peak periods and may reduce the continuity of loads on booster stations. Jackson[61] explains the procedure employed in **determining the capacity** required to obtain the best results with elevated tanks. Hebbring discusses the advantages derived from tanks at Wauwatosa,, Wisconsin. Horton[85] is concerned with improving the **artistic design** of elevated tanks and their painting and setting so as to contribute to the beauty of skyline, rather than detract from the appearance.

Smith[24] gives a great deal of information concerning desirable points in the design of **distribution reservoirs.** In connection with the lining of the Westcott reservoir at Syracuse, New York,[38] studies were made of the most satisfactory methods of applying cement by the **gunite process.** It was found that a nozzle velocity of 375 feet per second gave the greatest strength of gunite, showing a compressive strength with a fair quality of sand amounting to at least 5000 pounds per square inch. A 3½ inch coat of gunite was applied. The drainage of water from the slopes was accomplished by first placing six inches of crushed rock and then covering with gunite. Six inch tile were laid at the foot of the slopes. The tile were laid with open joints and led to a common drain. An anchor wall about half way down helped to prevent slippage. Westergaard[93] analyzes the pressures to which dams may be subjected during **earthquakes.**

The plans for the great **Colorado river aqueduct** to supply a group of cities in Southern California with water are explained by Hinds[63]. The work on the scheme is now going forward. However attempts[n47] have been made to **invalidate the bond issue** which was approved by popular vote on September 29th. The contract for the **45 mgd pumping line** over the Coast Range following the Corral Hollow route, which is to be a portion the Hetch Hetchy water development for **San Francisco,** was let recently[n46]. The contract price is reported to be $928,550. In New Jersey arrangements are being made to secure the **site for a reservoir area** capable of supplying 165 million gallons per day. A dam 950 feet long and 150 feet high would impound the water from a watershed of 64 square miles.[n45,n137] **Hartford, Connecticut,** voted favorably November 3rd on a plan to expend about $8,600,000 to secure additional water from the **East** branch of the Farmington river[n132].

Articles of Special Interest.

Allocation of water supplies available in western states, Conkling[62].

Rainfall and runoff records, McClean[115].

The **wettest places** in the British Isles, Glasspoole[109].

The tidal **Thames,** Kirkpatrick [101,31,35].

Flowing water for irrigation, Lacey[34,30].

Efficiency of **centrifugal pumps,** Beckwith[21].

The water supply of the **Shedd aquarium**[51].

The British viewpoint concerning **modern water pipe** is expressed by Macaulay[18] in a paper before the Institution of Water Engineers. The Federal **government specifications** for DeLavaud centrifugally cast iron pipe have been listed for pressures of 150 and 250 pounds in sizes from 4″ to 24″[107]. Wrapping a **cement coating** on a 66 inch steel pipe to be used in the 47 miles of pipe across the San Joaquin valley for the Hetch Hetchy supply for **San Francisco** reached a speed of 1400 lineal feet per 8 hour shift at the wrapping plant[39]. A light cast iron pipe sixty inches in diameter replaces the wood stave pipe that carried water to **Atlantic City** from the source five miles distant. Installation cost about $28.33 per foot[37].

Malcolmson[126] has developed a procedure for rapidly **installing copper service pipe** to replace galvanized iron or wrought iron service connections. The lead gooseneck is removed and the copper piping attached to the old service pipe. Using a reversed pipe pusher the old service is pulled out and cut off as convenient for trench work. The copper piping follows thru the passage left by the old service pipe. Detroit has been following a plan to **modernize all gate valves.** The plan to house all gearing and to run the gears in oil necessitated replacement of cast iron gears having moulded teeth and the substitution of cast steel gears with cut teeth[43].

Hibbs[86] presents a scheme for **uniform record maps** for the location of mains, gate valves and services as used at Cincinnati. Drawings are made on a scale of 50 feet to the inch using standard sheets 17x22 inches suitable for binding in loose-leaf binders. Photostat copies 11x14 inches are furnished repair and valve crews. At Sheboygan, Wisconsin[n14], **angle and distance referencing** of valve locations is assisted by the use of a rugged sighting protractor.

Articles of Special Interest.

Size of services required, Starbuck[28].

Meters should fit demand, not the service pipe, Brown[6].

36″ C.I. pipe line in New York was **lowered 16′ under pressure in 1856**[106].

Lexington, Ky., completed 4 Mgd supply line from Kentucky river in 70 days, Clark[36].

Sub-aqueous pipe lines, 8″, 12″ and 24″[84].

Laying **mains under railroad tracks,** Questionnaire replies[136].

Plant Descriptions.

Shreveport, La., Amiss[133]; Omaha, Nebraska, Leisen[104]; Lincoln, Nebraska, Anon.[105]; Warwick, R. I., Aldrich[n1]; East Creston, B. C., Leveque[22]; Bermuda, Anon.[n120]; Siam, Buchler[127]; Tunbridge Wells, England, Maxwell[114]; Hull, England, Bingham[112]; Liverpool, England, Davidson[110]; Bangor, North Wales, Davies[100]; Leek Urban District, Great Britain, Beacham[99].

Financial

Hoot[67] has found that poor accounting practices are common in water departments of cities of small size. Few make any considered attempt to plan for the **future financial structure** in a manner to be compared with Kunigk's scheme for the city of **Tacoma, Washington**[4, n27]. Bond[74] suggests that similar conditions have been noted in **Canadian** departments. The **accounting record of the physical equipment** is often in such condition that it is exceedingly difficult to figure depreciations to property intelligently and in manner acceptable for presentation in court or before commission hearings. Bankson makes suggestions for improvement of this type of record[81]. Blum discusses the ideas of the Treasury Department officials with regard to **depreciation allowances**[82]. Full information about property is important in marketing **utility securities**[83].

The details of water works **accounting practice** have come in for considerable discussion recently—chiefly at the meeting of the American Water Works Association in Pittsburgh last June. Among the matters debated were the advantages of the practice of **stub accounting**[68], **tabulating and billing machines** [69,70,73], control of **printed forms**[72], and permanent **meter reading books** or temporary **meter reading slips**[71]. The importance of proper **public relations** of the water department as always is before the water operator. Michaels[75] discusses the public as a **partner;** Morse tries to provide a **rating scale** on which to judge whether the relationship between the utility and the public it serves is as well established as it should be[76].

Articles of Special Interest.

Rate structures in Michigan cities show variation but average higher in the upper steps than the A.W.W.A. scale, Kennedy[80].

Diversion of Water works funds, Wright[58]. (Mentioned in August.)

State Franchise Taxes, Tobin[79].

Federal Income Tax for water works employees not yet settled[87].

Personnel problems of the water works, Dykstra[59].

Personnel rating by the Probst method, Majeske[77].

Noblesville, Indiana, provides work by building swimming pool[n7].

Forms for purchases by competitive bidding, Alfke,[78].

Operation

It has been generally assumed in water works circles that it was just for the consumer to pay the cost of **private fire protection.** The National Fire Protection Association apparently believes[5] that there is a public value to the private fire protection and that though the service should not be conducted at a loss to the utility, the entire cost should not be borne by the owner of the specially protected property. Out of his extensive experience on the subject of fire protection, Mowry[134] discusses the **amount of water required for community fire demand** and the advantages of supplementary water supplies of large capacity for use in emergency. Fawcett[103,113] complains that while pure water supplies are decreasing in availability, the **water demands of the British public** are trending upward. Water supplied by the **Metropolitan Water Board of London,** during the year ending March 31, 1931, averaged 278 million Imperial gallons per day[32]. This was an increase of 2.81 million gallons per day over the preceding year. **New York City**[n118] used 940 million U. S. gallons per day in 1929 and in 1930 used an average of 995 million gallons per day. Twenty million gallons per day were supplied to communities outside of the city itself. Thus the total demand was 1015 million gallons per day. The total quantity available is about 1100 million gallons per day.

Purification

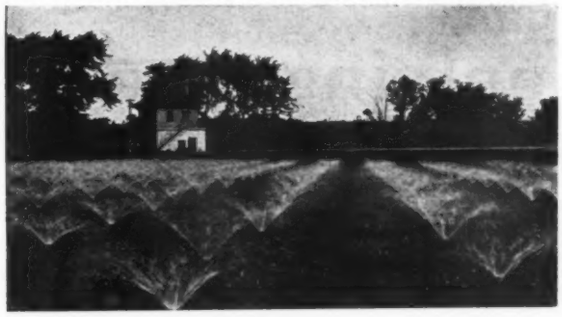
The committees at work on the selection of **filter materials**[26] have made considerable progress during the past year and are continuing their study on a wider scale. Fine **anthracite coal,** which has been used as a filtering medium at Dallas, Texas, and at Denver, Colorado, is urged as definitely better than sand by Farrell and Turner[135]. It removes the bacteria, color and turbidity at least as well as sand of equivalent size. It is claimed that the raw anthracite is **65% as adsorbent as activated carbon** and that the efficiency in removal of tastes and chlorine is worth much in the operation of the filter plant. Lyles[42] at **Tampa, Florida,** found that the velocities in the underdrain system of the filters were so great as to produce uneven washing. The gravel was displaced. Better results were obtained by reducing the amount of wash water per minute.

At **Los Angeles**[117] it has been found by Wilson that chlorine is most useful as an **algicide** against those organisms which are **nearest to the bacteria** in their relationships. These same organisms, such as the protococcus forms, are not so readily attacked by **copper sulfate. Preammoniation** at Cleveland, Ohio, has in the opinion of Ellms[n3] been most helpful in avoiding chlorophenol tastes during the few days a year when highly objectionable tastes are likely. If the ammonia costs 15c per pound, the cost of treatment was about 30c per m.g. Morris M. Cohn humorously enquires about the **chlorine residual of the operator himself**[124].

In investigating the **earthy tastes** so objectionable in some waters, Adams[102,111] comes to the conclusion that they are due to actinomyces in the soil that gonidia production by the organisms is necessary to the development of the taste. In acid soils the taste was not produced, probably because the organisms are present in reduced numbers. Soil extracts were prepared and placed under different conditions as, 1.) in the dark, 2.) exposed to sunlight, 3.) in an ice chest, 4.) under anaerobic conditions, 5.) aerated a few minutes daily. After 14 days there was no appreciable reduction in odor and taste. Taste in the sample in the ice box increased. Continuous aeration and treatment with hydrogen peroxide or chlorine did not remove taste. Large doses of potassium permanganate (1 in 1000) reduced it somewhat. Stirring in of chalk, clay, fuller's earth, keiselguhr, kaolin, sawdust, dried peat and non-

(*Continued on page 65*)

Sanitary Engineering



Estimating Amount of Refuse Collected

As we (and others) have said time and again, the only practicable way to determine accurately the amount of garbage or rubbish which is collected in a given municipality in a week, month or year is to weigh every load. But in some cases it is, or seems to be, impracticable to install and use platform scales for this purpose and some method of estimating must be substituted. A method recommended to us by Alden E. Stilson, of the Morse Boulger Destructor Company, is as follows:

"Arrive at the cubical contents of each wagon or truck as accurately as is possible. Weigh each wagon on a coal scales or other private scales—empty. Weigh one load brought in by each wagon every day for a week. Having the weight of the six loads brought in by each wagon, average this weight. By this method we then have a very close approximation of weight for the particular season of the year in which the work is done.

"We will assume that the weighing is done in the fall. If we are taking care of garbage only, the weights in the fall represent 95% of the weights that would be received in the summer, which will represent 100%, maximum production.

"If we are weighing rubbish only, we will assume that the weights obtained in the fall are 71.5% of summer production, which again is 100%.

"If we are taking a mixed collection, the proportion of garbage and rubbish will be 71.6:28.4.

"It is understood that these proportions are by weight of total, and it is further understood that by garbage we mean only those materials that are included in the definition: Garbage normally consists of the vegetable and animal waste from kitchens, resulting from the preparation of foods. Municipal garbage includes, as well, spoiled vegetables, fruits and meats discarded by markets or condemned by the health department."

The following table shows the average variation of garbage and rubbish production according to seasons, based on the summer collection as 100%. These proportions are based on data colected in several typical American cities:

VARIATIONS OF GARBAGE AND RUBBISH PRODUCTION

	SUMMER *July, Aug., Sept.*	*FALL* *Oct., Nov., Dec.*	*WINTER* *Jan., Feb., Mar.*	*SPRING* *Apr., May, June*
Garbage	100%	95%	75.5%	86.5%
Rubbish	100%	71.5%	73%	76.5%

"Data have also been collected as to seasonal variations in the proportion of garbage to rubbish. The following table gives the variations expressed as percentages of the total collections.

PROPORTIONS OF GARBAGE AND RUBBISH
% By Weight of Total

	SUMMER *July, Aug., Sept.*	*FALL* *Oct., Nov., Dec.*	*WINTER* *Jan., Feb., Mar.*	*SPRING* *Apr., May June*	*Average*
Garbage	63%	71.6%	66%	67.3%	67
Rubbish	37%	28.4%	34%	32.7%	33

"If it is impossible to obtain the use of a coal scale for the period of a week, we would suggest that a spring balance be obtained capable of weighing up to 200 pounds. Next a container having a capacity of at least 2 cu. ft. should be obtained and its weight determined empty.

"As the garbage is allowed to flow from the truck in dumping, let the empty container be filled, allowing the impact of the garbage as it falls do the packing.

"Weigh the full container, and determine the weight of the contents by subtracting the weight of the empty container from the total. Repeat this process for at least one load per truck per day for a period of approximately a week.

"Knowing by this means the approximate average weight of a cubic foot of material from any one of the wagons or trucks, multiply this weight by the cubical contents of the truck or wagon and thereby know the average net weight of the individual truck's load for the particular season of the year for which the work of weighing is done."

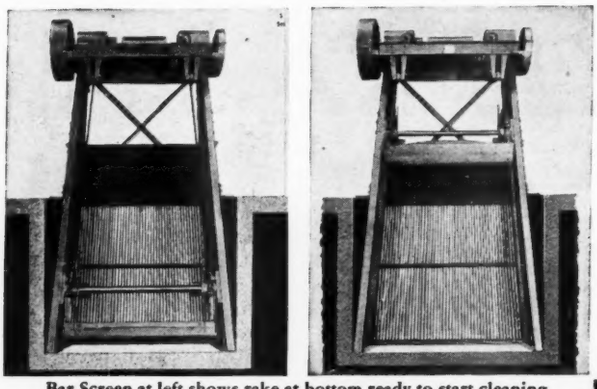
Mechanical Apparatus in Sewage Treatment

In its 1931 report, the Division of Sanitation of New York's State Department of Health, Charles A. Holmquist, director, discusses as follows the tendency in New York State to adopt the latest improvements in equipment and methods for treating sewage:

"It is interesting to note that in the construction of new treatment works, there has been a marked tendency to make use of more units equipped with mechanical apparatus. Mechanically operated bar screens and fine screens, grit removal apparatus, sludge collectors, separate digestion tanks with floating covers or with mechanical stirring apparatus, and activated sludge installations are finding their proper place in the field of modern sewage treatment. As an example of a new plant, making use of such equipment, is the village plant at East Rochester, which is equipped with a bar screen, mechanical grit chamber or Dorr detritor, a water cleaned drum screen of the

(Please turn to page 61)

Applying STRAIGHTLINE Principles
To Sewage Screens, Aerators and Collectors



Bar Screen at left shows rake at bottom ready to start cleaning screen bars, and right shows rake at top ready to return.

STRAIGHTLINE
(Trade Mark Registered)
BAR SCREEN
(Patents Pending)

Strength and reliability are the outstanding features of this screen. The clear opening of the bars may be as small as ½". Width of screens varies from 3'0" to 11'0".

STRAIGHTLINE
SLUDGE COLLECTOR
(Patents Allowed and Pending)

Efficiency, simplicity of operation, and their long service records, are reasons for the large number of plants now being equipped with Link-Belt STRAIGHTLINE Sludge Collectors.

Settling Tanks equipped with Sludge Collectors at the Lakewood Sewage Treatment Plant.

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Dorco type, a cylindrical two story sedimentation and sludge digestion tank equipped with a mechanical sludge collector, sludge stirring apparatus and gas collector, a dosing tank, trickling filter and final settling tank. The new treatment works at Middletown consists of coarse bar screens, a mechanical grit chamber or Dorr detritor, a mechanical bar screen of the Dorr type, chlorinating apparatus, settling tanks equipped with Link Belt sludge and scum collecting apparatus, separate sludge digestion tanks equipped with Downes floating covers for gas collection, and both open and glass-covered sludge beds. Provision has also been made in this plant for recirculation of the sludge in the digestion tanks and utilization of the gas produced in the tank to heat the sludge. The plant at Hamilton has a bar screen, primary settling tanks, separate sludge digestion tank equipped with a floating cover for collection of gas for use in heating the sludge, dosing tank, trickling filter, final settling tanks and sludge beds.

"There has also been a noticeable trend toward the installation of a large number of glass enclosed sludge drying beds. These enclosures have proved to be a valuable adjunct in the control of odors and in making it possible to dry sludge, independent of weather conditions, throughout the year. The area required for sludge drying facilities has in general been reduced 50 per cent by the erection of such beds. Glass covered installations have recently been constructed at the plants at Dundee, Dunkirk, Cheektowaga District No. 3, Ithaca, Middletown and the Mount Vernon District and Woodlawn District of the town of Hamburg.

"During the year 133 inspections of 74 municipal sewage treatment plants have been made by engineers of the Division of Sanitation. Material improvement in the operation and efficiency of a large number of these plants has been brought about by advice and cooperative efforts.

"Chlorination plays an important role in the protection of water supplies, bathing beaches and shellfish beds, and in the prevention of nuisance conditions in the streams into which plant effluents discharge. The efficiency of chlorination in these plants is determined and controlled in general by the making of frequent tests for residual chlorine in the plant effluent. Monthly reports on the operation of sewage chlorination plants are being received from over 30 sewage treatment plants in the State and a few reports are being received regularly from plants which have other treatment than chlorination."

Suction Dredge for Newark's Reservoirs

What is believed to be the smallest suction dredge using cutter machinery which has ever been built is being used by the Division of Water of Newark, N. J., for removing deposit from Macopin intake reservoir, where about 28,000 cubic yards of mud, sand and leaf mould has accumulated in the 26 years since the previous cleaning. These deposits vary in depth from a thin coating to 4 feet and have been causing turbidity of the water and deposits in the mains. The material was too compacted to yield to straight suction methods and a combination suction and cutter was decided upon.

The reservoir covers about twelve acres, and to reach all deposits a hull with not more than 2 feet draft was necessary. Also the dredge could not be floated to the reservoir, but must be carried there by truck, and this necessitated a structure which could be "knocked down." Another advantage of this is that it can be carried to other reservoirs where it may be desirable to use it. The dredge used will dig to a depth of ten feet below water.

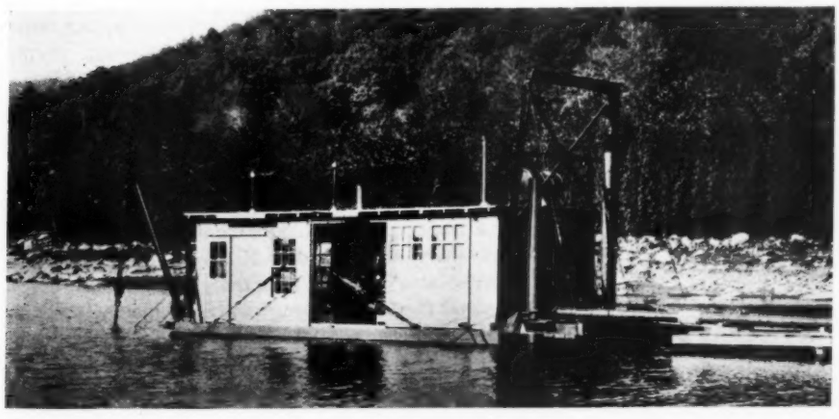
This dredge has an electrically welded steel hull built in two sections, each 31x7x3 feet, which were launched from the truck into the reservoir and then bolted together, forming a hull 31x14x3 feet depth. The hull is trussed internally like a bridge, to resist the high stresses to which its use subjects it. The "truss-weld" type of hull which was adopted is said to combine high structural efficiency with low weight and hence greater portability.

The hydraulicking equipment consists of a gasoline engine driven pump capable of delivering 1000 gallons a minute at 92 pounds pressure through three 1¼ in. nozzles. The engine is a 6-cylinder, 4½x6-inch, rated at 90 h.p.

The dredge pump is a Morris Machine Works heavy-duty type H, with 6-inch suction and discharge, with a complete inner casing of manganese steel; which material is used for all wearing parts also, because of the shock caused by the large stones which will probably pass through the pump. This is driven by a 112 h.p., 6-cylinder gasoline engine with 6x7¼-inch cylinders. The pump is designed for 1250 g.p.m. against 125 feet total head. The dredged material is discharged through 8-inch pipe, including fifteen 30-ft. and two 10-ft. pontoons, with 1320 feet of shore piping.

Maneuvering is accomplished with a 5-drum winch, driven by a 4-cylinder gasoline engine, similar in size to the one which drives the cutter.

The hull was built by United Dry Docks, Inc., of New York. The cutter equipment is standard Morris Machine Works design. The discharge pipe was made by the Naylor Pipe Co. of Toncan iron spiral weld, with Victulic coupling for the shore pipe. The equipment was supplied by Pierce J. McAuliffe, New York distributor, to the Newark Department of Public Works of which James W. Costello is chief engineer, Herman Rosentreter being the engineer of water supply.



Baby suction dredge used by the city of Newark, N. J., for removing deposit from the Macopin Intake. This dredge is 31 feet long and 4 feet wide and draws 2 feet of water.

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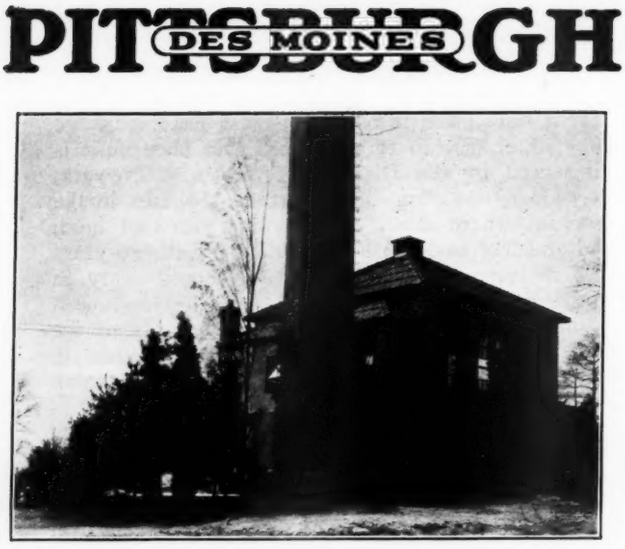

EXTERIOR REAR VIEW—PELHAM MANOR, N. Y.

Completed in November, 1931, This "Pittsburgh-Des Moines" Incinerator Serves Pelham Manor, North Pelham and Pelham

The Pelham communities in lower Westchester county are known as New York's "beautiful homes" district. Their municipal buildings and civic improvements also reflect the good taste and refinement of these exclusive suburbs. There was no reason why their new modern incinerator should not harmonize effectively with the typical Pelham setting.

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The "Pittsburgh-Des Moines" plant burns *all* of the garbage as fuel to give low operating costs. Its practical construction and improved design have been proved in many clean American cities.

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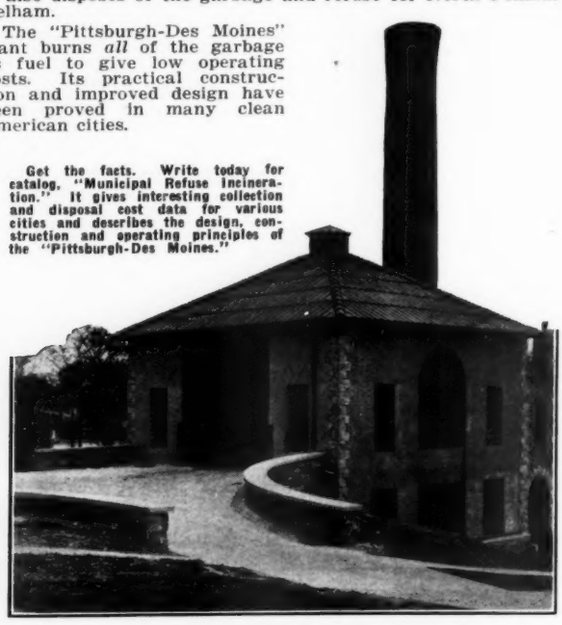

EXTERIOR FRONT VIEW—PELHAM MANOR, N. Y.

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Sanitary Engineering Projects for Unemployed Relief

"From the viewpoint of public health workers, it is a matter of grave concern that sanitation projects for better environment are curtailed in States having 62 million population and are 'seriously curtailed' in States aggregating 38 million."

This statement is made in a report recently submitted to the Conference of State Sanitary Engineers by a committee on sanitation projects for unemployment relief. The figures are based on information obtained from state health departments during October and November. Departments of 42 states reported, showing that in 18 of these, containing 51 million population, sanitary engineering projects were proceeding as usual, but in the remaining 24 they had been curtailed, moderately in 13 states with 24 million population and seriously in 11 states with 38 million population.

Bond issues for sanitary engineering projects were reported as having been authorized in 17 states, defeated in 4 states and not submitted in 15 states; these reports representing the general trend in the several states.

Fortunately, the personnel on water works and sewage treatment works has not been greatly affected by the depression. No states report that they have been seriously reduced, only 5 that there have been any reductions, and 37 states containing 95 million population report no reductions. In the 5 states only 6 million people are served with water which is purified.

In connection with spending unemployment relief to the best advantage, the committee remarks: "There are still many communities in the United States which do not, but should, have safe public water supplies, and many others where existing water supplies need improvement and extension of service to give pure water to people living in parts of towns now dependent upon wells and springs possibly of doubtful purity; in many communities new sewers and sewer extensions are needed in order that menaces to health from insanitary privies and overflowing cesspools may be permanently abated. Square miles beyond number of swamps and wet lands need to be controlled to reduce the malaria menace from mosquitoes, and also houses in the malaria districts need screening to protect the inhabitants. These needs, coupled with the fact that an increase in disease is to be expected during and following a protracted period of general unemployment, present a profoundly urgent problem which public officials, health authorities and sanitary engineers must face and promptly solve, for the doing of all these things will both give employment and safeguard health."

Removing Earthy Tastes in Water

In a paper presented at a conference of the British Waterworks Association, B. A. Adams, discussing the cause and removal of earthy tastes in water, said that most waters coming into contact with surface soils acquired such tastes unless the soil was acid.

It was known that earthy tastes could be removed by means of activated carbon, and according to Liddle (1931) this process had been utilized at Hamm, Dresden and Magdebourg in Germany, and at the Southend waterworks. There were two methods of

application—(*a*) passage of the water through beds of activated carbon, and (*b*) the addition of the finely divided carbon to the water, which was subsequently filtered.

Through the courtesy of the makers, the author had been able to examine the effect of particular activated carbons on earthy tastes derived from soil. "Hydraffin T II," "Hydraffin S I" (granular materials), and "Nuchar N 2" (very fine powder) were the carbons employed in these experiments. At first the earthy tastes were produced in the water by allowing samples to stand in open vessels for a few minutes in a cupboard in which petri-dish cultures of *Actinomyces* were exposed. Subsequently, all earthy tastes were prepared from soil extracts. It was found that the tastes were removed invariably and completely by the passage of the water through the granular materials. With the powdered carbon it was necessary to add rather large amounts to remove completely the very strong tastes, but otherwise complete removal was effected by practicable quantities. With the "indeterminate" tastes produced by chlorinating diluted soil extracts or *Actinomyces*-odor solutions, both forms of the activated carbon were completely successful in removing the tastes.

Financing Sewage Disposal Plants in Ohio

Twenty-two Ohio municpalities last November voted on bond issues for water supply, sewerage and sewage disposal projects, eleven for water supplies and twelve for sewerage and sewage disposal (one of these for both). Of these, only three municipalities voted for water projects, only one for sewage treatment, and none voted for bonds for sewers. The law requires a 60 percent majority to authorize a bond issue. Five of the municipalities that rejected the bond issue proposals were under state order to construct the necessary sewage disposal facilities for correction of stream pollution nuisances

In commenting on this the Ohio Board of Health says:

"In view of the outcome of the municipal elections, it would appear that some other means of financing sewage disposal improvements must be followed. There is a perfectly practicable way of accomplishing such improvements where they are badly needed. In 1923 the General Assembly enacted what is known as a 'Sewer Rental Law' which was an enabling act permitting Ohio municipalities to place the sewerage system on almost the same basis as the water system, namely, as a utility. In other words municipalities are permitted to collect charges for sewerage and sewage disposal service on a schedule of rates which the municipality may determine to its own satisfaction; the revenue thus derived may be used for operation and maintenance of the sewerage and sewage disposal devices, and any surplus may be applied to the sinking fund charges on bonds, or for direct expenditure toward sewage disposal improvements.

"The first municipality to take advantage of this way of financing was the village of Oxford, which started to charge for sewer service in 1925 with the result that in 1929 it was enabled to build a new sewage disposal plant, funds for which were obtained largely from the earnings of the sewer department. The largest municipality that has financed in this manner is the city of Dayton. A new plant, recently

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placed in service in that city, is being paid for out of the sewer rental fund. Each Dayton householder that uses the sewer system pays approximately $4.00 per annum. It is possible to arrange the schedule of charges so that each user of the system pays in direct proportion to the use he makes of the system, namely, in proportion to the volume and strength of the sewage (especially in the case of a manufacturing establishment). This is essentially the same manner in which charges for water service are made, as such charges vary in proportion to the volume of water taken. About twenty Ohio municipalities are paying for their sewage disposal service under provisions of the sewer rental law. All it requires is an ordinance of council establishing standard rates of service charges

"Ohio municipalities really desiring to clean up stream pollution nuisances and prevent costly lawsuits for damages can proceed, if they choose to, by adopting this method of financing, as above described, without placing undue burdens on taxpayers but putting the cost where it really belongs—on users of the system."

Water Meters in Chicago

Chicago had in service 85,845 water meters at the beginning of 1931, as against 80,905 at the beginning of 1930. About 30% were ⅝-inch; 8% were ¾-inch; 40% were 1-inch; 11% were 1½-inch; 7% were 2-inch; 1½% were 3-inch; and the remaining 2½ were 1¼, 4, 6, 8, 10 and 12-inch; besides 15 automatic meter alarm valves, 6 hydraulic elevator dials, and 7 fire valves. Of the meters installed during the year, 94% were ⅝-inch, 4% were 1-inch, and the remainder were 3,4, 6, 8 and 12-inch.

The average cost per meter of installation was $13.64 for the meter, $3.22 for material, $16.16 for labor to control, test and deliver, and $3.32 for truck operation; a total of $36.34.

There were 25,812 jobs of field work repairs and replacements, for which the labor cost was $72,237; material cost, $20,500; and truck operation $22,536; a total of $115,273. This included repairing 10,891 meters on premises, at an average cost of $2.62; replacing 10,513 meters, at an average cost of $4.65; also investigations, removing meters, etc. There were 36,029 jobs of shop work, involving $129,895 for labor and $19,831 for material. Of these, 12,991 were testing and sealing meters after repair, at an average cost of 61 cents; 12,813 were repairing meters, at an average cost of $7.04; 9,659 meter parts rehabilitated, at an average cost of $1.89. These costs include maintenance of equipment and autos, supervision and clerk hire.

On the basis of the total expenditures of the meter division (which does not include reading), the average cost per meter for maintenance was $3.13. This is the smallest annual average yet recorded, there having been a gradual reduction from the maximum of $4.68 in 1925.

The percentage of services metered was 20.76; the percentage of consumption metered was 32.98; and the percentage of revenue from metered services was 68.3.

The division for several years has been studying the advantage of using the size of meter most suitable for each case. In 1928 it was demonstrated that changing meters 3-inch and larger to smaller ones of a size indicated by the consumption resulted in

an average daily increase in registration of 600 cu. ft. per meter. In 1929 it was shown that reduction of 2-inch disc meters to 1½-inch disc increased the registered consumption 23½ per cent. In 1930 forty-eight 3-inch compound meters were substituted for 3-inch straight meters, and an increase in registered consumption was obtained in 28 of them and a decrease in 20; but the net result was an increase from an average of 2,165 cu. ft. per day to 2,508, or 15.8%. In 23 of the 28 cases the increase after the change was more than 10%; in four it was 100% or more. In discussing this last comparison, the report says: "The installation of compound meters requires a larger investment in capital and a larger upkeep, especially if located where considerable sand is found in the water; therefore recommendations of this kind should be made only after a thorough study of usage conditions."

Salvaging in Baltimore

Household rubbish to the extent of 111,082 tons was collected in Baltimore in 1930 by contract and delivered to the city's two incinerator plants, from which the city salvaged paper, rags, bottles, metals, rubber, etc. The prices received for these were generally lower than formerly: paper, the largest item, bringing 16 cents a hundred pounds, compared to 25 cents in 1929.

The records give the costs of reclaiming the several classes of wastes and the amounts received for them, as follows: Mixed paper and magazines—costs, $24,903; revenue, $32,036. Rags, carpets, curtains, etc.—costs $5,494; revenue, $9,930. Bottles and broken glass—costs, $9,925; revenue, $13,708. Tin cans—costs, $11,062; revenue, $8,100. Scrap iron, other metal and rubber—costs, $3,125; revenue, $3,704. The total receipts were $68,257.

Other costs of operation at the incinerator plants, including repairs, supervision, etc., but with no allowance for interest or depreciation, brought the total to $215,822; giving the net cost $147,565, or $1.33 per ton of rubbish brought to the plant.

Drifting for Water

Potable water is scarce in the vicinity of Miami, Arizona, where two large copper mines are located, but test borings in a nearby valley showed a limited supply. To develop this for the maximum supply possible two shafts were sunk to bed rock and long drifts were dug radiating from these on top of the impervious stratum, one drift connecting the two wells. A total of 766 feet of drifts gathered the ground water into the wells, furnishing a supply adequate for the needs of the community.

The Water Wheel

(Continued from page 54)

taste producing earth (prepared by steaming) removed taste incompletely. Filtration of the water through these substances removed the taste completely, but the property became exhausted in a short time. Evidently **adsorption** produced the effect. By treatment with **activated carbon** the odor and taste were removed completely. Bayliss[119] continues his discussion of **charcoal and activated carbon,** paying especial attention to the characteristics of activated carbon in the current in-

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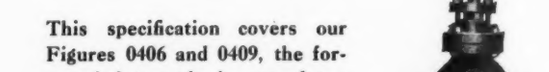

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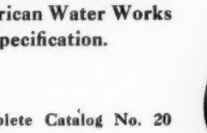

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stallment of his paper. Waring[112] and Fitzgerald[130] both comment favorably upon the use of activated carbons for taste and odor elimination.

Softening of the water supplies of the London, Midland and Scottish Railway requires 28 lime soda plants on its two main lines[n33]. The average hardness of English waters is about 15° Clark, but many important supplies have hardnesses of 20 to 22 degrees. Reddington, Birkenbine and Speller[57] contribute an excellent general account of the **corrosion of water mains. Nigh**[50] discusses particularly the corrosion of **heating boilers.** Two interesting papers concerning **iron-secreting bacteria** in relation to water main tuberculation have appeared under the authorship of Reddick and Linderman[129], and Langenberg, Linderman and Reddick[108]. Straub[92] considers particularly the **alkalinity determinations** on water when writing of the use of chemical analyses of water in studies on embrittlement of boiler metal.

Articles of Special Interest.

Modern aspects of **water purification** in America, Chase[19].

U. S. Public Health Service conclusions concerning value of **prechlorination** of water during treatment, Anon.,[n2].

Large industrial water softening plant at **Newton-le-Willows, Lancs.**[29].

Boiler feed water studies summaries[91].

Review of three books on **water witching,** Wolman.

Gravel wall wells, Quinn.[60].

Developing wells with compressed air, Williams,[55].

Geological difficulties encountered in well drilling,[52].

The Drought

Berry[64] suggests that it is **not economical** to burden a water works plant with the expense necessary to prepare adequately for a **drought** which may be experienced only once in twenty-five to 100 years. Better take the emergency measures when required for immediate protection. Very severe shortages were met in many localities during 1930 and 1931: in a few places there was no water available. **Quality of water**[66] was subject to certain effects of which the most important were development of **microorganisms** with accompanying odor, taste and operation difficulties, increase in **hardness** and in some localities of **acidity, chlorophenol** formation on treatment, **oxygen deficiency,** development of **high concentrations of wastes** with **odors and tastes** due thereto. The effects of the drought are not yet past in some places[96]. Rains have been absorbed by the ground to some extent and **low stream flows are again the cause of concern** in some Southeastern states[40]. Hoyt[65] has made an extensive **hydrological study** of drought conditions.

Swimming Pools and Bathing Places

Even the **common bath** is not without its dangers[53]. Great care is required to make swimming pools safe, even with vigilant life guards on duty. The experience of the **South Park Commission of Chicago** is crystallized in an article by V. K. Brown[14] on the design of outdoor pools. Operation of fifteen pools, ten of which had been in service for more than twenty years, has given the operators very definite ideas as to what is required in a satisfactory outdoor pool. Most accidents have been found to take place in the **center of the pool** where the shallow water is deepening into a zone of greater danger. A **barrier of steps** up and then down is the most original contribution to pool safety, so designed that no person can get into the deeper water unaware. The finding of **Leptospira** in London waters has caused some wonder as to why no epidemic

of jaundice has been reported[11]. Gould and Carter[8] report that the organism **Trichophyton interdigitale** which is implicated in ringworm of the foot, when placed on a **woolen jersey** was able to survive for at least two months, though there was no evidence that it had grown in the meantime.

Articles of Special Interest.

Jones Beach Pool of the Long Island Park Commission unusually fine, Prager[13].

Glen Echo Park pool at Washington, D. C., Schoeppe,[12].

New public bath with **pool and teaching basin** at Leipzig, Germany, Ritter[48].

Marshall Street Baths and Public Laundry in Westminster, London[15].

Public Baths of **Baltimore,** Kelley[16].

Kitsilano Beach ocean pool at Vancouver, B. C., Wooton,[23].

Design for an outdoor pool installation to cost $110,000 to $120,000, Becker[10].

Investigational and Various

McCord and Ferrenbaugh[90] recommend the **addition of 0.25 to 1% of sodium chloride** to water taken by soldiers when sweating profusely. It has been found that such a solution is less likely than water alone to aggravate the condition of the dehydrated tissues, gastric hypoacidity, acidosis, fatigue, exhaustion, muscular and **gastro-intestinal cramps** which frequently accompany excessive and prolonged sweating.

Manganese has been shown by Hopkins[98] to be necessary to the growth of **Lemna minor** and to the unicellular alga, **Chlorella.** The amount of manganese required is very small. White[94] feels as do other workers that **nitrate nitrogen** is often a controlling factor in the essential food of the algae in ponds. Imhoff[49] showed that in the **cycle water-sewage-water** brought about by modern purification equipment, the nitrate content mounted from ten to 122 parts per million in eleven cycles. Chlorine as chloride in the same period rose from 48 to 380 parts per million.

Spaulding[9] reports contamination of mains by the **jute packing** used. Coliform organisms were present. Aftergrowths in new mains were annoying. In one instance 180 part per million of chlorine were put into a new main and then after standing for a time flushed out with water. Coliform organisms were detected in 0.1 milliliter of the water taken **immediately after flushing.**

Articles of Special Interest.

Chloride of lime stabilized by quicklime keeps reasonably well in the tropics for a time, Wats and White[89].

Procedure for taking **samples of sand** from wells, Williams[56].

Absorption of Dyes by Bacteria affected by pH of medium, French and Wright[95].

Fluorescence of bacterial cultures is produced only in presence of magnesium, and the phosphate and sulfate ions, Georgia and Poe[88].

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ENGINEERING SOCIETIES

The Road Show

The 29th Annual Convention of the American Road Builders' Association, and the annual Road Show, opens a full week of interesting and valuable sessions on January 11 in the Detroit Municipal Airport Building. During the week more than 40 sessions will be held on the various phases of highway finance, design, construction and maintenance. It is obviously impossible to give here the complete and detailed program, but the general arrangement of sessions is as follows:

Monday.—Afternoon: Highway Location; Administrative Relationship of State and County; Bins, Batchers and Equipment for Handling and Weighing Bulk Cement; City Officials' Session.

Tuesday.—Morning: Motor Freight; Plain and Reinforced Concrete Highways; County Highway Officials; City Officials. Afternoon: Motor Freight; Maintenance; Construction and Equipment for Low Cost Roads and Bituminous Surfaces; County Highway Officials; City Officials.

Wednesday.—Morning: Brick Pavements; Central and Truck-Mixed Concrete; City Traffic and Traffic Devices; Highway Contractors. Afternoon: County Highway Officials; City Officials; Pan-American Session; Highway Contractors.

Thursday. — Morning: Grading Methods; Low Cost Bridges; City Officials. Afternoon: Equipment; County Highway Officials.

Truck Association Executives of America

The Truck Association executives of America will hold their anual convention in Detroit January 11th and 12th at the Book-Cadillac Hotel. They have invited the consolidated truck terminal operators of the United States to meet with them.

Associated Equipment Distributors

The Associated Equipment Distributors will hold their annual meeting in Detroit January 9th and 10th at the Book-Cadillac Hotel.

Association of Asphalt Technologists

With a program of papers, discussions and committee reports dealing with new and important developments in asphalt road building machinery, asphalt paving research and new and improved mixing and construction methods that have been brought about during the past year, the Association of Asphalt Paving Technologists will hold its annual meeting for 1932 in connection with the Annual Road Show and Convention of the American Road Builders' Association. Two sessions, morning and afternoon, will be held at the Municipal Airport Building on January 14. A third, or business session, as well as a meeting of the board of directors, will be held on January 13 at the Book-Cadillac Hotel.

Charles A. Mullen of Montreal, Quebec, president of the Association of Asphalt Technologists, will open the meeting with the president's annual address and will preside during the morning sessions. Henry L. Howe of Rochester, N. Y., first vice president of the association, will preside in the afternoon.

Items From the Field

The Asphalt Institute, New York, through the Managing Committee, Pacific Coast Division, announces the appointment of Daniel B. Miller as managing engineer, in charge of activities on the Pacific Coast. Western offices for the Asphalt Institute have been opened by Mr. Miller at 206 Sansome Street, San Francisco. B. E. Gray, highway engineer at the main offices of the institute in New York, is now in San Francisco, where, with Mr. Miller, he is organizing the work of the Pacific Coast Division and coordinating it with that of the main office.

President B. C. Heacock of Caterpillar Tractor Co. has announced the following personnel changes: Paul Weeks will assume charge of the Washington, D. C., office, under the title of "Washington Manager;" L. B. Neumiller assumes the duties of Service Manager; L. G. Morgan becomes General Parts Manager; R. H. Gardner supersedes W. H. Goodwin as Assistant Sales Manager, and W. H. Goodwin will work directly with Mr. Bell on territorial matters.

J. N. Barnes, C. M. Burdette and F. G. Nunneley have been appointed Assistant Sales Managers in charge of District Representatives and a group of dealers for Caterpillar Tractor Co., Peoria, Illinois.

The C. H. & E. Mfg. Co. and the Insley Mfg. Co. of Indianapolis, Ind., have withdrawn from the National Equipment Corporation. Frank F. Hase, the organizer and now president and general manager of the C. H. & E. Co., is again in full control of that concern. While this action, which was approved by the directors and the stockholders, severs official relationships, it is announced that the various companies will continue to work in cooperation. The C. H. & E. Co. manufacture portable saw rigs, pumps, hoists, mortar mixers, elevators and small ditching machines. The Insley Mfg. Co. manufactures concrete equipment and power shovels.

The Four Wheel Drive Auto Company of Clintonville, Wisconsin, has recently added another shift to take care of the increased demand for FWD trucks. Officials of the company state that never before in the commercial history of the FWD organization have more undelivered orders been on the production schedule. Starting early in August, there has been a gradual increase in the demand for FWD products from state, county and municipal governments, commercial haulers and contractors. The majority of trucks for highway departments include specifications for the adapting of snow removal equipment, such as dual-motored units, high mounting of headlights and heater-equipped cabs.

Sales engineers recently appointed to the Special Sales Division of the Caterpillar Tractor Co. include W. J. Dukes, in charge of engine sales; G. A. Bell, Jr.; C. D. Hurley, J. M. Howell and Harold G. Tufty.

The Wellman Engineering Company, Cleveland, O., has purchased the clamshell bucket and heavy duty trailer business of the G. H. Williams Company of Erie, Pennsylvania, and the engineering, manufacture and sale of these products will be transferred to the Wellman headquarters in Cleveland.

The Norwood Engineering Company, general offices and works Florence, Mass., has just appointed W. C. Hanson, 50 Church St., N. Y., in charge of sales in the New York Metropolitan District, for their line of swimming pool, industrial and municipal filters and accessories.

The Signal Service Corporation, with main offices in Elizabeth, New Jersey, announces that it has acquired the Traffic Engineering Division of the American Gas Accumulator Company of Elizabeth, New Jersey, and the Ray Signs Corporation of New Haven, Connecticut. It will hereafter conduct the business of these groups in the development, production and sale of traffic devices.

The Truscon Steel Company has taken over the Berger Manufacturing Company Building Products Division at Canton, Ohio, and will continue to operate it as Berger Building Products Division of the Truscon Steel Company, continuing with Berger's present policies and retaining on their staff their present selling organization.

International truck registrations in the New York area for the first nine months of 1931 show an increase of 56 per cent over those of the same period for the previous year, as compared to a loss of ten per cent for the industry, according to E. Burke, Manager of the New York City International Harvester Company Branch.

Road Show Exhibits

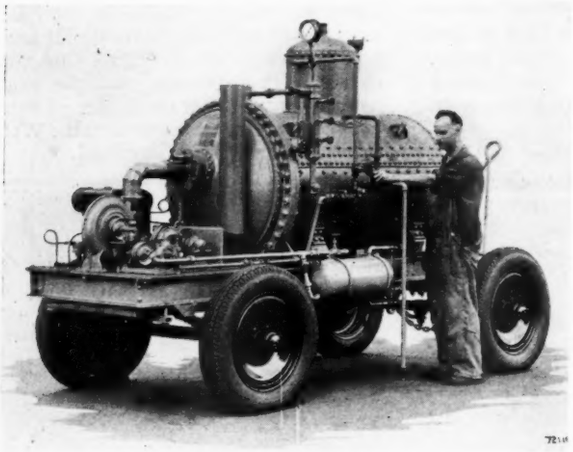
Blaw-Knox Co., in Space 119, will show the improved Ord finisher; aggregate and cement weighing batchers; road, street and sidewalk forms, clamshell buckets and the Ateco hydraulic scraper.

Wood Hydraulic Hoist and Body Co. will maintain open house for all out-of-the-city visitors at its Detroit plants, and, in 307, will show both miniature and full size models of hoists.

White Co. will feature a newly developed motor truck for collection of garbage and refuse and for snow removal. It will also display a 6-wheel unit designed for heavy construction work, and a display truck.

Federal Motor Truck Co. will exhibit two new models, a 1½-ton 6-cylinder chassis, and a high-speed 5-6 ton unit, for heavy hauling and construction.

Littleford Bros. have not disclosed the nature of the most important part of their exhibit, which will be an entirely new product; in addition they will have the usual display of their equipment in Space 114.



Cleaver Tank Car Heater

Hauck Mfg. Co., in 312, will show an asphalt emulsion sprayer, an asphalt melting kettle, oil burning asphalt surface heater, weed burners and portable oil burning torches.

Waukesha Motor Co. will include in their display a 6-cylinder Diesel engine which will be shown for the first time.

Armco Culvert Mfrs. Ass'n will show most recent developments in drainage structures in Space 201, including Armco Metal Cribbing and Armco Paved Invert Pipe.

Toncan Culvert Mfrs. Ass'n will show standard round corrugated sections, nestable culverts, flat-bottom culverts, perforated drains and Tyton sluice gates. Toncan Booth is 303.

Huber Mfg. Co., in Space 129, will show a 10-ton motor roller, a 5-ton motor roller and a Huber Maintainer, which will be shown for the first time.

Pierce Equipment Corp., Chicago, will exhibit the "Bear" Rollers, which are made by the Pierce Governor Co.

Four Wheel Drive Sales Co. will show two trucks in space 211, the HH6 of 2½ tons, a road building and maintaining machine, and the 1932 6-wheel 6-ton truck, model X6.

Kohler Co. exhibit of portable electric lighting and power plants will emphasize construction and operation features, and their adaptability for lighting for night construction work.

Colprovia Roads Inc., will show motion pictures, photographs and descriptive matter demonstrating developments in road construction.

Owen Bucket Co. will show a complete line of buckets, with all improvements made during the past year, in Space 236.

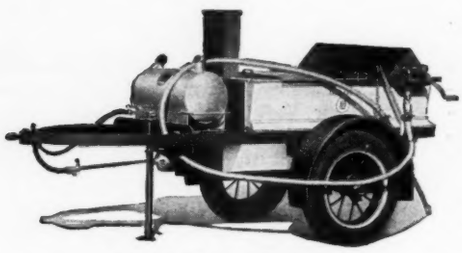
Gledhill Road Machinery Co., Galion, O., will display one of their new graders in Space 212, and during the show will announce their new line.

The organization of a new corporation, the Cleaver-Brooks Company of Wisconsin, has just been announced. This new company will manufacture and market "Cleaver Tank Car Heaters," the "Cleaver Bituminous Boosters," "Cleaver Hot Water Boosters," and other equipment used for heating all grades of bituminous materials, aggregates and water for central mixing plants, central proportioning plants, large construction work where winter mixing of concrete is carried on, as well as for the furnishing of hot water requirements for industrial plants. The officers of the new company are J. C. Cleaver, President, and R. E. Brooks, Secretary and Treasurer, both well known. Mr. Cleaver was formerly with J. C. Cleaver Co. Inc., and Mr. Brooks was president of R. E. Brooks Co., N. Y.

The Huber Maintainer

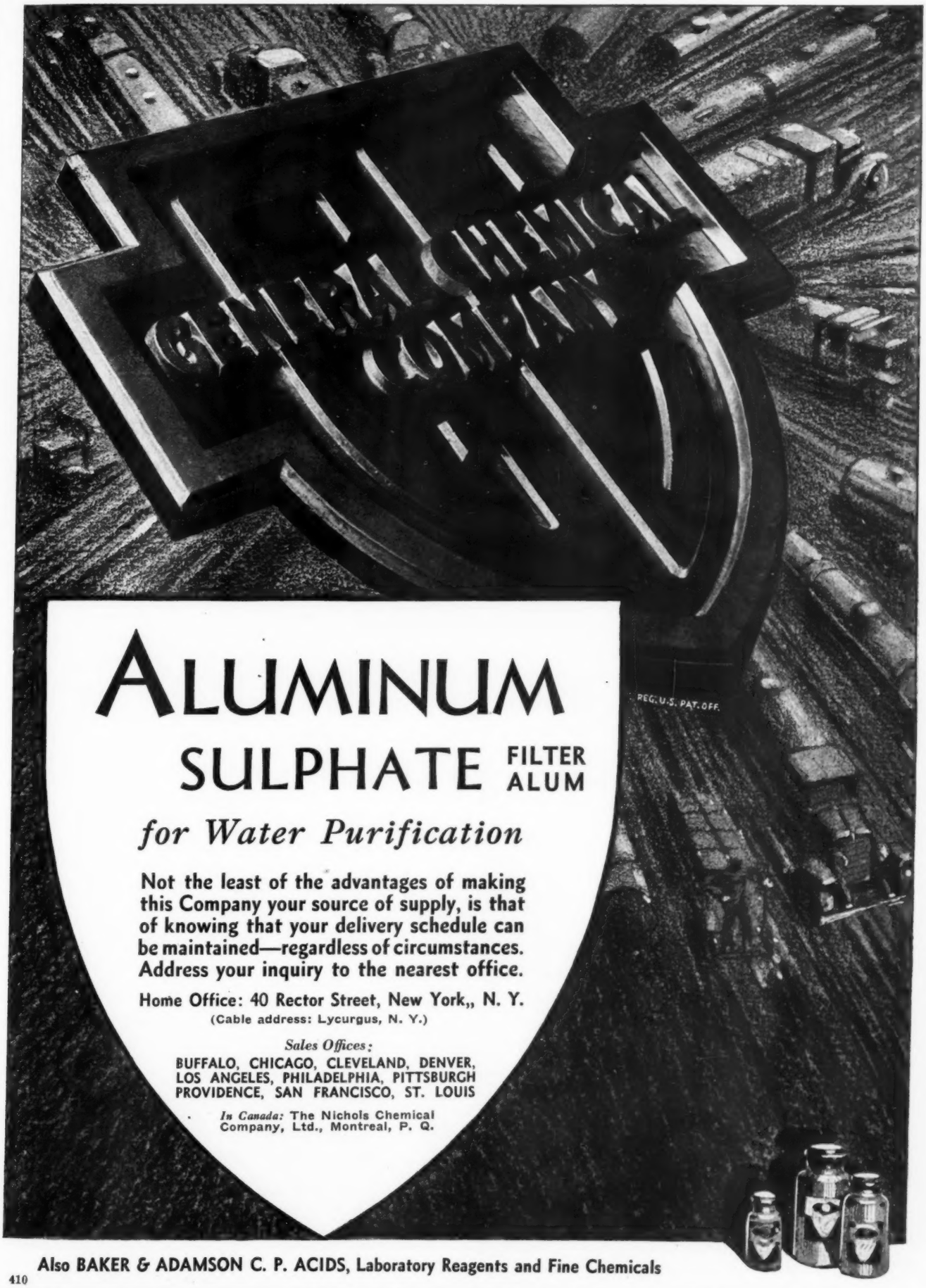
The Model D Cleaver Tank Car Heater was first shown at the 1931 road show in St. Louis. This equipment fills a need for a portable unit for the heating of asphalts, tars, road oils, and other viscous materials; among central mixing plant owners; and on large concrete operations for the heating of aggregates and water for winter mixing.

The Cleaver-Brooks Company's offices are located at 740 North Plankinton Avenue, Milwaukee.



Littleford 84 HD Kettle

Four Wheel Drive Road Builder



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For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 75

New Ideas for the Contractor, Road Builder and Dirt Mover

(Continued from page 31)

New Rex Moto-Mixer With Hoist

A new hoist for truck mixers, called the Jackass Hoist, has been developed by the Chain Belt Company, Milwaukee,

New Rex Mixer with Hoist.

Wisc., for their line of Rex Moto-Mixers and Moto-Agitators.

This new hydraulic Heil hoist raises the mixer eight feet from the ground, from which height the concrete can be spouted over an area approximately 75% greater than heretofore. Sidewalks can be poured across parkways without wheeling. Building foundations and walls can be chuted even when the truck cannot get within ten to twenty feet of the hole. Alleys and streets can be fanned their full width. The hoist raises the drum high enough to discharge into a three-yard hopper. The flow of concrete can be regulated easily by the operator from a slow trickle to a full discharge by a simple turn of a handwheel. Though the mixer is raised at a considerable angle, the drum empties itself cleanly and thoroughly.

A Tubeless Tire for Tractor Service

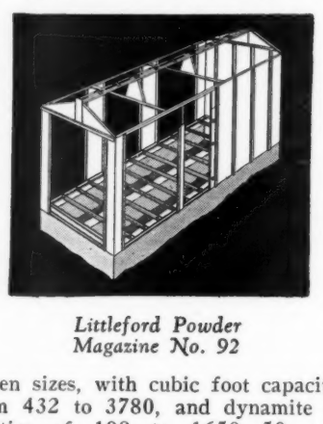
A tubeless tire—the "Zero pressure" tire—has been developed by the B. F. Goodrich Rubber Company of Akron, Ohio, for agricultural and industrial tractors and slow speed, steady pulling vehicles. Its construction is a rubber arch built on a perforated steel base for application to standard solid tire rims or French & Hecht expansion wheels. Penetrating objects cause little tire damage and no delay because of the elimination of tubes.

This new tire was used in experimental tests in the citrus groves of Florida and on the rural highways of Iowa before it was introduced to the public. The line includes nine sizes, ranging from 30x6 to 42x12. Three weights are made in the 46x11 size, each designed for special service: the light tire, the Florida special, and the heavy duty.

Littleford Explosives Magazines

Littleford Bros. Co., Cincinnati, O., manufacture weather-proof portable explosives magazines which are suited for the field storage of explosives. No. 63 is made of 12-gauge sheet steel, and is ventilated through hooded screens. The inside is black, and the outside aluminum. This magazine is made in three sizes with capacities of 50 to 120 kegs.

The No. 92 magazine is of the sectional storage type, which is quickly erected or taken down. This magazine, while not bullet proof, meets state requirements for storing blasting or sporting powders. It is made in sev-



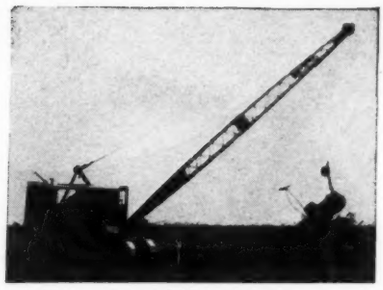
Littleford Powder Magazine No. 92

enteen sizes, with cubic foot capacities from 432 to 3780, and dynamite capacities of 198 to 1650 50-pound cases.

A New Link-Belt Shovel-Crane-Dragline

Link-Belt Co., Chicago, Ill., has just announced the Type K-48, the newest

Goodrich "Zero Pressure" Tire



Link-Belt K-48.

of the six sizes of their line of shovels, cranes and draglines. This all-purpose unit is arranged for gasoline, diesel or electric. As a shovel it handles a 1¾-yard dipper; as a dragline, the same, or next size larger, bucket. As a trench hoe, in normal digging, it handles a 2-yard bucket. The K-48 is mobile and fast as smaller machine, is easily transportable, and is very stable despite its reasonable weight.

Rotator Drills

Sullivan Machinery Company, Chicago, Ill., announces a new light-weight rock drill, Class "L-1," which weighs only 30 lbs. and is only 17 inches long. It may be equipped with either tee handle or single grip handle, as required by conditions, the single or center grip being preferred for underground work where drill is held up by the operator for horizontal or upward holes.

The "L-1" drill has shown its adaptability for light ledge drilling, for block holing or plugging for secondary shooting, for coyote hole jobs in road building or quarrying work; also for drilling rock and coal in strip pits and for underground work in trimming walls, taking up bottom or trimming roof, etc. The compactness and lightness of this tool, together with its relatively high drilling power and speed indicate a wide field for it. "L-1" uses ⅞-inch standard steel and is rated at a capacity of 6 to 8 feet in depth in ordinary service.

A Cletrac 30 tractor owned by Mr. R. J. Odman, a contractor of Seattle, Washington. The equipment is what is known as the Ateco sheeps foot stamper and it is being used for scraping, levelling and tamping approximately 40,000 yards of dirt on the eastern approach to the new Aurora Avenue bridge over Lake Union, Seattle.

TO HELP YOU IN YOUR WORK, ANY OF THIS

INDUSTRIAL LITERATURE

WILL BE SENT **FREE** UPON REQUEST

IT is a good practice to check this list regularly because descriptions of new bulletins are always being added.

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of booklets issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction. Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Use of and specifications for Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250. yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company, Cleveland, Ohio.

Asphalt Rollers

12. How to use rollers to save tamping costs. A 16-page booklet printed in two colors gives full details and also specifications of the Erie Roller. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

15. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Use the coupon.

16. Steel storage bins, measuring equipment for proportioning concrete aggregates, cement and water, ready-mixed concrete plants, truckmixing and agitator bodies are described in Catalog No. 1302. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

28. A 32-page catalog descriptive of all types of Blaw-Knox Dreadnaught Clamshell Buckets, illustrating various construction features and giving a complete list of type and sizes. Ask for No. 1234. A complete catalog on dragline buckets, No. 1247, will also be sent on request. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by the title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Copies will be supplied to those who ask for it. Issued by Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Culverts—Large Diameter

59. The Culvert Handbook, containing 56 pages of typical culvert installations and much valuable data pertaining to all kinds of drainage problems. Toncan Culvert Mfrs. Assn., Massillon, Ohio.

60. "Large Diameter Corrugated Pipe," lists the advantages following the use of larger diameter culverts in meeting small bridge requirements. These are ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service. Armco Culvert Mfrs. Association, Middletown, Ohio.

Dirt Moving

61. A complete description of equipment and a valuable cost data on dirt moving. Bulletin No. 1310 descriptive of Blaw-Knox Dirt Moving Equipment including the Blaw-Knox "Ateco" Dirt Mover, the Blaw-Knox Wagon Grader, Scarifiers, Bulldozers and Tamping Rollers. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

Dump Bodies of Steel

70. Ford and other small truck body and hydraulic hoist equipment are described and fully illustrated in a technical publication. The Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Excavating Buckets

73. Excavating Buckets — shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on rerequest. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

74. Asphalt and Concrete Finishing—Bulletin No. 6, completely describes the Ord Road Finisher and its application to the finishing of all types of concrete and asphalt pavements. The Blaw-Knox Company, P. O. Box 915, Pittsburgh, Penna.

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Forms, Concrete

76. Steel Forms for concrete road, curb and sidewalk construction are fully described in a recent publication by The Heitzel Steel Form & Iron Company, Warren, Ohio.

Graders

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of the "Caterpillar" graders which are built to set new records in yards of earth moved, in miles of road maintained per dollar expended.

78. A 28-page bulletin describes the Austin 101 Leaning Wheel grader and its application for road construction and

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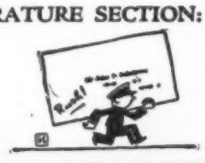

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maintenance, heavy ditching and grading, bank sloping and scarifying. Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill.

Hammers, Selfpowered

82. A new bulletin describing and illustrating the wide adaptability of use of RODAX, a portable self-powered, gasoline driven hammer, has just been issued by the Rodax Corp, 2199 Lumber St., Chicago, Ill.

Hydraulic Hoists

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Hydraulic Hoists for every make and model of Truck. Wood Hydraulic Hoist and Body Company, Detroit, Michigan.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. Catalog of interest in colors. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

106. "Operating Trucks Profitably in Contracting"—A 24-page survey covering thousands of motor fleets, with practical data on efficient truck operation and what to consider in selecting new equipment. General Motors Truck Company, Pontiac, Mich.

107. "Operating Records for Motor Trucks" is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations. Dodge Brothers Corp., Detroit, Mich.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. A series of publications just issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Pumps, Contractors'

120. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming centrifugal pump, for automatic continuous prime on suction lifts up to 28 feet. Described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

121. "Road Construction and Maintenance" takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. A valuable publication for the contractor or road official. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages, illustrating the machines at work under many conditions. Issued by the Caterpillar Tractor Co., Peoria, Ill.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. "Road Machinery." A sixty-four page data book describes road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog. Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill. Illustrated, printed in 2 colors, it contains comparative specifications, tells of the construction and materials used, explains why they have the enviable reputation for capacity and for staying on the job.

Rollers

130. HERCULES, 6-cylinder road roller. Gasoline engine. Sizes 6, 7, 8, 10, 12 and 15 tons. Three speeds forward and backward. Illustrated catalogs and descriptive material. The Hercules Company, Marion Ohio.

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

139. Up to date information on portable sand and gravel washing plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Screens

141. Full information concerning shaker and revolving screens, conveyors, elevators, bins and chutes. Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 issued by Bay City Shovels, Inc., Bay City, Mich.

145. 28 pages, 50 illustrations, action pictures and charts. Completely describes the light half-yard and the full half-yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. Lifting capacities and working ranges for the different sizes and types of the complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet which is now ready for distribution by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. A 140-page manual of engineering and surveying instruments covering levels, plane tables, transits, current meters and supplies, such as hand levels, barometers, etc., is published by C. L. Berger & Sons, Inc., 37 Williams St., Boston, 19, Mass. (Also published in Spanish and in Portuguese).

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawler

169. The use of crawler tractors in roadbuilding and maintenance, earth moving, excavating, grading, snow re-

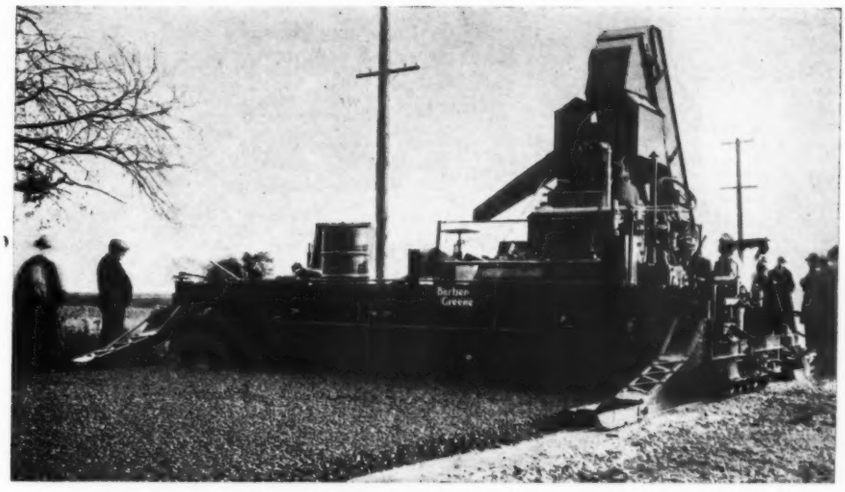
SWEET'S
STEEL POSTS
STRONG DURABLE POSTS
for every kind of Fence and Sign Post requirements —
SWEET'S STEEL COMPANY - WILLIAMSPORT, PENNA.

Barber-Greene Bituminous Paver

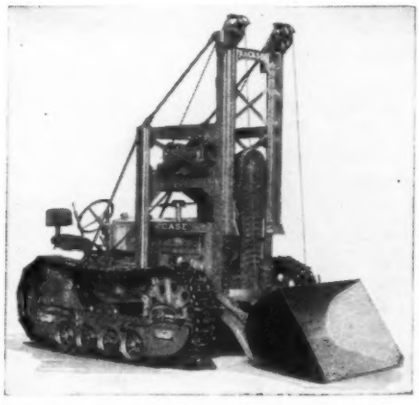
A most promising innovation in road-building equipment is a new Barber-Greene machine which provides a continuous system of mixing, laying, spreading and tamping, in one operation, and without the use of forms. In operation, one mile of pavement is laid per 10-hour day. A description of the construction of a section of road by this equipment is described on another page in this issue. The machine consists of two primary units, the loader-mixer and the spreader-tamper. The aggregate is placed in a windrow in the center of the road, ahead of the machine. Bituminous materials are brought by distributor truck, which maintains the bitumen at a predetermined heat.

The loader-mixer unit is similar in appearance to the standard Barber-Greene bucket loader equipped with a spiral pick-up feeder, a storage hopper, a spray chamber and a double pug mill. It gathers, proportions and mixes the material, discharging it into or in front of the spreader-tamper unit. This is mounted on two crawlers, straddling the road from shoulder to shoulder. The material, already properly coated with bitumen, is spread from the center across the road by two horizontal spiral ribbon screws, one for each half of the road. Immediately behind the spreader is the tamper which, with a weight of 6,000 pounds behind it, works all of the material under the screed, acts as a strike-off and compacts the material to a uniform density. Immediately behind the tamper is the screed, which also has a compacting action and operates a half cycle behind the oscillations of the tamper itself. This tamping, screeding and compacting action, along with the action of the shoes and evener levers, provides an excellent and smooth surface.

Due also to the fact that the time required for the bitumen and aggregate to be combined and compacted in the road does not exceed two to four minutes, bituminous materials that will set up rapidly can be used.



Barber-Greene Bituminous Paver at Work.



Trackson High Shovel Mounted on Case Tractor.

Austin Western Powerful New 101 Grader.

Trackson High Shovel on Case Tractor

The Trackson Company, Milwauke, Wis., announces that its High Shovel is now adapted to the Case-Trackson Heavy-Duty Crawler Tractor. From heavy digging to skimming the ground in clean up work or loading bulk materials this unit provides the action necessary to a thorough job. It has all the advantages of a low-lift shovel in digging and, in addition, a sufficiently high dumping clearance (7 ft.) to load high body trucks from the sides or rear.

The bucket is controlled by a single lever, raising in 10 seconds and lowering in 5, and has a lifting capacity of 3000 lbs. The shovel unit in no way interferes with the drawbar operation of the tractor.

New Heavy Duty Hydraulic Hoist

The Perfection Steel Body Company, Galion, Ohio, is producing a heavy-duty hydraulic hoist for all 1½-ton short-wheelbase chasses, with a complete line of steel bodies. An outstanding feature is the "Cushion Drop" mechanism or automatic control which gives it the advantage of dropping the body, either full or empty, very rapidly to the riding position, yet without "slamming" he frame. The "hydraulic cushion" becomes effective when the body frame comes to within several inches of the chassis, then it eases down to the full riding position.

This hoist raises the load to a full 50-degree angle in less than four seconds and returns it by controlled gravity to any intermediate position.

The Austin 101 Grader

This powerful new grader has a blade 23 inches high, stiffened with a 90-pound rail. The operator not only can watch the blade all the time, but can raise, lower, side shift and reverse with surprising ease. The frame is of heavy 12-inch channels. All principal gears have machine cut teeth and are of steel, malleable iron or bronze.

moval, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes. Bulletin 562. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O.

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line ranging in size from the 12 h. p. model to the powerful 100 h. p. tractor. The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½-tons at a 10-ft. radius, for mounting on a 5-ton or 7½-ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by Wood Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. New bulletin is now available. Issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

203. A 54-page booklet describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc. Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, profusely illustrated, tells of the design and construction of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Issued by the Caterpillar Tractor Co., Peoria, Ill.

Highway Mowers

223. A new Motor Sickle Highway Mower, cutting from eight to twenty miles per hour, has been designed for mowing highways. Has a cruising speed while not mowing up to fifty miles per hour over smooth surface roads. Full details on construction and operation from Rawls Mfg. Co., Streator, Ill.

Surface Heaters

225. The new "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is fully described and its use illustrated in Bulletin 16 just issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

226. "Mixed - in - Place Construction." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products is now ready for distribution. Recently published by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. Culvert Handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to all kinds of drainage problems. Toncan Culvert Mfrs. Assn., Masillon, Ohio.

238. A 24-page, well-illustrated booklet lists the advantages that follow the use of Armco corrugated iron culverts and contains complete instructions for ordering and installing. Armco Culvert Mfrs. Association, Middletown, Ohio. Culvert Catalog No. 6.

Jacking Culverts

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road wth 'Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Garbage and Refuse Disposal

304. The Holzbog line of sanitary wagons especially designed for low cost collection of wet or dry garbage and refuse is fully described and illustrated in a 16 page catalog published by Geo. H. Holzbog & Bro., Jeffersonville, Ind.

Incinerators

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Fences

347. A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types ow snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the new Frink type S snow plow for trucks. Carl Frink, Mfr., of Clayton, N. Y.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Describes the new Type "S" Frink Snow-Plows and Frink Leveling Wings. Published by Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight are contained in an illustrated folder issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

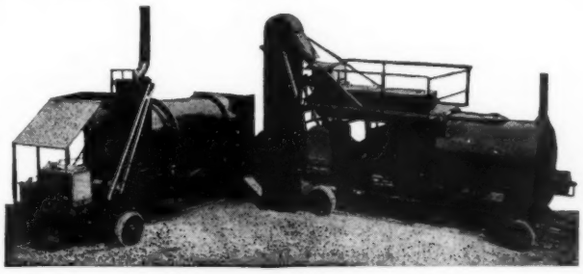
404. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Pumps—Sewage

410. Non-clog vertical and horizontal sewage pumps and their characteristics

A New Bituminous Pre-Mixing Plant

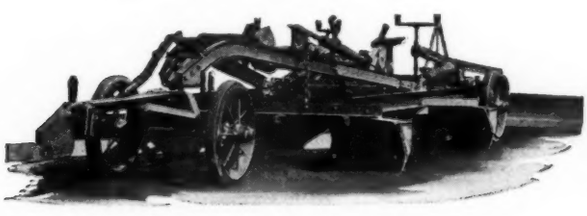
A new machine which, it is stated, enables the construction of hard-surfaced pavements at a cost of about $5,000 a mile has been developed by the Chausse Oil Burner Co., Elkhart, Ind. This is a complete asphalt plant, built in two units, both of which are mounted on rubber tired steel wheels, making them readily portable. One unit is the drier, equipped with oil burners, through which aggregate is fed. This, thoroughly dried and heated to 300°, is discharged into an elevator, which feeds it into a continuous blade-type pug mixer. Any amount of bitumen up to 12% can be added. The machine, which is equipped with two Hercules engines, weighs about 13 tons, complete. It is especially adapted to produce paving mixes from bank run gravel and will operate equally well on either hot or cold mixes.



Chausse Bituminous Pre-mixing Plant.

Galion Mixing and Leveling Drag

This machine is especially designed for mulch or retread work and accomplishes a thorough mixing of the material and levels it ready for rolling. It is a development of the Galion multiple blade maintainer but has 15-inch moldboards and double-bevel blades for edges instead of the flat blades of the maintainer.



Galion Mixing and Leveling Drag.

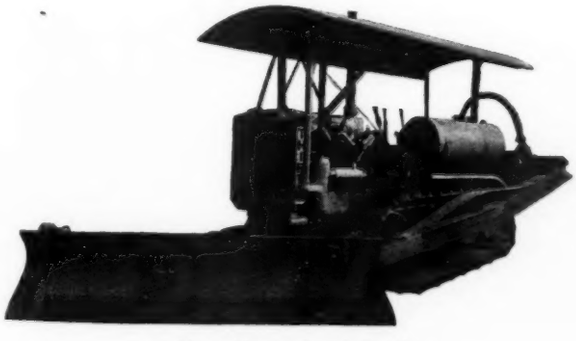
It is furnished with direct tractor hitch; rubber-tired wheels; Timken wheel bearings; enclosed lift gear cases operating in grease; weights counterbalanced by springs so that the controls operate with ease; spring mounted operator's seat, and only four controls conveniently located within reach of the operator.

A wide range of adjustment is provided by the controls, including adjustment of the strike-off blade and the drag unit. The strike-off had a three-piece blade, adjustable for crown, a plumb bob and degree indicator being provided. An automatic edger, 22 feet long, is built into the machine to prevent choppy "road waves."

The width of this drag is 10 feet, and that of the rear strike-off is 11 feet.

LaPlante-Choate Roadbuilder

The new LaPlante-Choate Roadbuilder has been designed primarily for use in building trails, and in digging in uneven ground, rocks, clay, decomposed granite, and similar materials where the going is rough. It has a 36-inch hydraulic jack lift, with a special mold-board, having heat-treated cutting bits at either end of the blade, which are especially designed for cutting into the side of the hill or mountain. This unit is easily removed from the tractor, which can be used for other purposes. The moldboard is designed to roll the excavated material forward and to one side. The blade can be set at a 30-degree angle, thus performing the function of both bulldozer and backfiller.



La Plant-Choate Road Builder.

Littleford Weed Burner.

Littleford Weed Burner

Littleford Bros. Co., Cincinnati, O., manufacture the weed burner shown herewith. This is suitable for clearing weeds from gutters, drainage ditches and rights of way along highways and railroads.

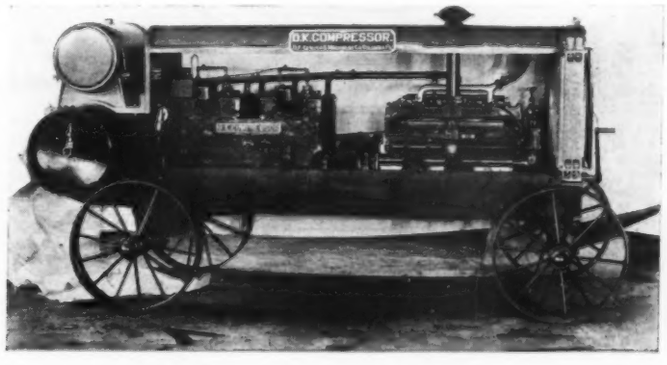
New Sullivan Drifters

Sullivan Machinery Company, Chicago, Ill., announces three new Drifters for tunneling and mining work, also for heavy down hole drilling from tripods or quarry bars in channeling or line drilling. These machines include the following: "T-7" 3-inch cylinder, 122 lbs. for holes to 15 feet; "T-6" 3½-inch cylinder, 159 lbs. for holes to 20 feet; "T-5" 4-inch cylinder, 190 lbs. for holes to 30 feet and up.

A Smooth and Efficient Air Compressor

Using a 4-cylinder compressor, and a 6-cylinder engine, the new 240-ft. portable air compressor of the O. K. Clutch & Machinery Co., Columbia, Pa., is said to be very smooth running, and to have an efficiency of 75%; that is, an actual production of approximately 190 feet of air is obtained.

There are many improved devices on this unit, including carburetor and engine control, which idles the engine while the compressor is being unloaded, and speeds it up before it begins to load. An improved type of valves results in elimination of leakage and valve trouble, it is claimed.



O.K. 4-Cylinder Portable Air Compressor.

are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

411. Full information regarding sewage pumps is given in publication 210, and a large number of sewage pump installations are illustrated and described in publication 193. The American Well Works, Aurora, Ill.

Sewage Screens

415. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Sewer Maintenance

416. Illustrated booklet describing Adjustable Turbine Sewer Cleaners, Self-Propelling Ferret Turbines, Drag Type Sewer Cleaners, Five Types of Sewer Rods, Conduit Rods, Windlasses, Sewer Braces, Sewer Cables. Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc.

418. "The Expanding Root Cutter and Sewer Cleaning Method," a 32-page booklet prepared by the Expanding Sewer Machine Co., Nappanee, Ind., gives full details as to methods and equipment needed for sewer cleaning.

Sludge Bed Glass Covers

419. Folder, standard filing size, contains model set of specifications and 11 x 17 inch drawings showing standard sizes and construction details of King Glass Enclosures for sewage treatment plants. King Construction Co., 539 Wheatfield St., North Tonawanda, N. Y.

420. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Glass-Overs

421. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Sludge Treatment

422. A new 48 page catalog dealing with Downes Floating Covers and Sludge Digestion Equipment has just been issued by the Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Catalog is very complete and includes interesting photographs of installations of floating covers and technical data on the subject.

Storm Sewers

424. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data regarding the use of Toncan Copper Molybdenum Culverts for economical and lasting storm sewers, drainage information, etc., will be gladly sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant. The Pacific Flush Tank Company of Chicago and New York.

429. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

430. The Dorr Company, 247 Park Ave., N. Y., publishes Bulletin No. 6171 which describes the treatment of sewage with Dorr Traction Clarifier an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C. publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Hydrants

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

506. Hydrants tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Jointing Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meters

520. 36-page booklet describes many valuable features in water meters including the chromium-shell gear train, patented frost bottom, ultra-simple design and other exclusive features. Buffalo Meter Co., 2920 Main St., Buffalo N. Y.

Meter Boxes

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps. The Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet. R. D. Wood & Co., Philadelphia.

535. "Data Book"—Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors, 48 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

539. "Handbook of Cast Iron Pipe" contains useful tables and data for the Water Works man on pipe line construction, weights and dimensions. U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe Line Construction

550. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumps, Centrifugal

560. Centrifugal pumps for high or low service pumping for waterworks and filtration plants. Bulletins contain installation photos, characteristic curves, and valuable design data. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

561. Centrifugal Pump data—Double suction centrifugal pumps are described in Bulletin 197; multi-stage centrifugals in Bulletin 200; deep well turbines in Bulletin 211, and a number of municipal pump installations in Bulletin 178. The American Well Works, Aurora, Ill.

Pumping Engines

575. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Screens

576. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Storage

579. "Modern Water Storage" is the title of a new booklet just issued by the Pittsburgh-Des Moines Steel Co., 3454 Neville Island, Pittsburgh, Pa. It contains 28 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems. Copies free on request.

Tank and Stand Pipe Data

582. A 50-page booklet issued by Pittsburgh-Des Moines Steel Co., 3479 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants. Much valuable data in handy form for the water works engineer.

Tapping and Valve Machines

583. Descriptive matter dealing with many labor saving devices such as the Smith tapping machine valve inserting machine and pipe cutting machines. The A. P. Smith Company of East Orange, N. J.

584. A new booklet just issued by Mueller Company, Decatur, Ill., fully describes and illustrates the new line of Mueller Tapping Sleeves, Valves and Drilling Machines for water works officials.

Valves

585. Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. Data book furnished upon request. Also data on "Dart" Unions and Fittings. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Water Development

590. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps, will be sent promptly on request. Layne & Bowler, Memphis, Tenn.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

599. The Toncan Culvert handbook, containing 56 pages of typical Toncan Culvert installations and much valuable data pertaining to the use of Toncan Perforated Iron Drains and Culverts for economical and permanent drainage of landing fields, will be sent free upon request. Address Toncan Culvert Mfrs. Assn., Massillon, Ohio.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125. Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. Berger engineering and surveying instruments are described in Catalog B. 140 pages. Other publications sent on request include Test and Adjustment of U. S. Coast & Geodetic Survey precise level, and Berger Focusing Systems. C. L. Berger & Sons, Inc., 37 Williams St., Boston, Mass.

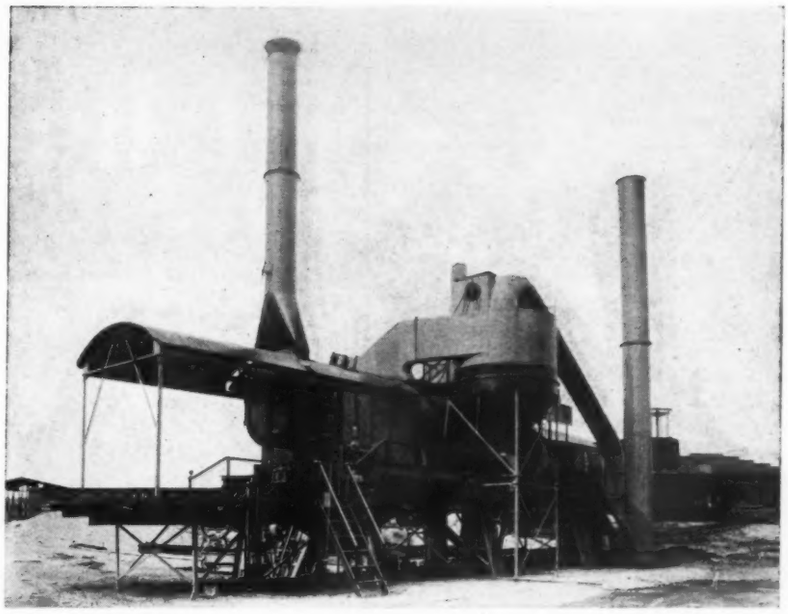
630. Transits and Levels particularly adapted for City, County and State work are fully described and illustrated in a new 64-page catalog just published by the Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

Simplicity Asphalt Paving Plant

The Simplicity System Co., Chattanooga, Tenn., asphalt plant has a capacity of 500 tons or more per day. Among the features which contribute to lower costs of production and greater output are said to be: The improved dryer, utilizing the maximum heat from one fire; durability, giving years of life without burning out; and capacity, which, under very favorable conditions may average over 600 tons per day.

The Simplicity Plant may be started or stopped instantly at any time. On patch work a plant may be started and stopped twenty or thirty times a day.

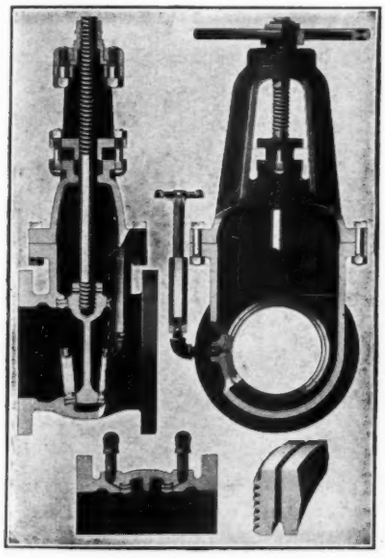
Ten tons of coal, or 1,400 gallons of oil, it is said, will produce 5,000 yards of 2" asphalt per day. There is only one fire for all purposes.



The Simplicity Asphalt Plant Has Many Valuable Features.

Lubrotite—A New Principle in Gate Valves

The Reading-Pratt & Cady Co., Inc., Bridgeport, Conn., manufacture the Lubrotite gate valve, in which there is a unique duct system for introducing lubricant seal between the seating surfaces. The valve is sealed tight, even though the seating surfaces have become damaged from sand or gravel in the line, or from corrosion, it is claimed. Other advantages include very easy operation, seating surfaces protected from corrosion, reduction in yearly expense and long life. Even after a long period of disuse, the valves open easily.



Valve with Lubrotite.

Full information regarding this new principle can be obtained from PUBLIC WORKS or from the manufacturer.

Goodyear Tractor Tires

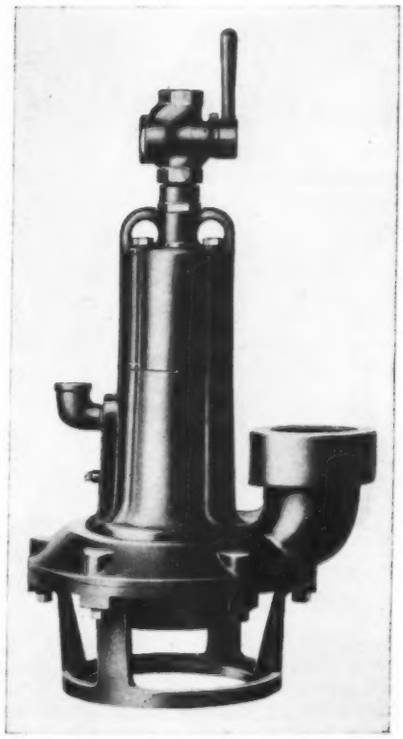
The new Goodyear pneumatic lug rubber tractor tire is designed for tractor speeds, tractor weights and stresses, for tractor requirements of surefootedness and drawbar pull under all conditions. Its carcass is especially designed and constructed for the low pressures recommended and an efficient tractive tread design is provided. It is made in four sizes; 36x6, 38x7, 40x8 and 42x9. Wheels for changeovers of present tractors are available through tractor dealers or through rim and wheel distributors.

Goodyear Tractor Tire.

Centrifugal Sump Pump

A new centrifugal sump pump, the Cleco-Deming pump, has just been produced by the Cleveland Pneumatic Tool Co. of Cleveland. It is designed for general contracting work, including sewer, gas and water pipe jobs, ditch and trench digging, and construction involved in the building of coffer dams, foundations, bridges and other structures.

The motor of the pump is operated by compressed air and is automatically lubricated from a reservoir located in the cylinder body. The air consumption is from 15 to 20 cubic feet per minute less than any similar type of rotary pump. With a twenty-foot head, the capacity of the C-D pump is 142 gallons a minute at 90 pounds air pressure and 137 gallons a minute at 80 pounds air pressure. The unit weighs 36 pounds. Its outlet connection is a 2½-inch standard pipe thread and its air inlet is ½-inch standard pipe thread.

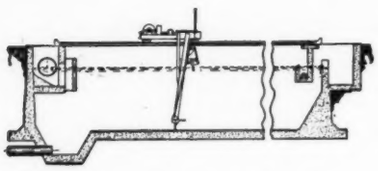


Cleco-Deming Sump Pump.

Hardinge Clarifier Mechanism

The Hardinge Clarifier mechanism for the removal of sludge in rectangular sedimentation tanks consists of a bridge crane spanning the tank across the narrow dimension. From the bridge is suspended a framework carrying the slugde scraper and skimmer. The bridge crane is driven by means of an electric motor and automatically reverses at each end of the tank.

The sludge scraper at the bottom of the tank moves the sludge in one direction, and on the return trip, the scraper blade is turned parallel with the bottom of the tank, thus creating a minimum of mechanical disturbance. The scum



Hardinge Clarifier Mechanism

scraper is also arranged to move the floating matter in one direction and to lift out of the liquid on the return trip. The lifting and lowering of the scrapers are automatic mechanical operations. The scum trough may be placed at either end of the tank.

The Hardinge clarifier mechanisms are manufactured for tanks varying from 10-ft. to 65-ft. in width.

Two Hardinge rectangular clarifier mechanisms have been in continuous operation for over six months at the sewage treatment plant at Columbus, Kansas. A similar unit has been installed at the sewage treatment plant at Morristown, N. J., and is now being placed in operation.

The Filclorator

The Filclorator is designed to prevent chlorinator troubles. Placed on the line ahead of the chlorinator, it insures the delivery of clean gas. It is claimed

To Prevent Chlorinator Troubles

to eliminate the necessity for blowing off tanks, to cost nothing to maintain and to require no attention. It has been developed by the Filclor Co., Philadelphia.

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AND NEVER LOST A MINUTE

"WE ARE UP TO SCHEDULE—WORKING CONTINUOUSLY 12 HOURS A DAY . . ."

Wm. H. Sturgeon, Supt.
Dravo Contracting Company

"The old river bottom sure comes up when these buckets get to work on it" remarked the Superintendent on this Ohio River Channel excavating job, at Belleville, W. Va. Two heavy duty Owen Clamshell Buckets are helping the Dravo Contracting Company keep to schedule on this important time contract. Much of the work is in hard-pan gravel, not an easy job for buckets—and they have to take plenty of punishment. "Boulders from 500 lbs. to 7 tons brought up—exceptional loads in hard river bottom digging—no time lost." These are statements, made on the job, that vouch for the rugged and efficient qualities of Owen Buckets in action. They are "coming through" on time without trouble on a tough job. This is an Owen's way of satisfying the Dravo Contracting Company. It is the usual satisfying way of an Owen Clamshell Bucket.

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A MOUTHFUL AT EVERY BITE

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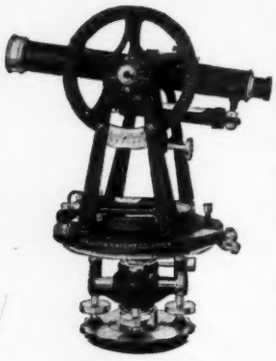

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Send me 64 page illustrated catalogue PW62 of Warren-Knight Transits and Levels showing inside views of re-inforced construction.

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UNUSUAL opportunity exists for high type men in any part of United States to organize their own businesses and earn large profits at once.

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Without obligation, please send me full details of your plan which will enable me to start an immediately profitable business.

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Recent Publications

Planning of Airports With Needs of Future in View

Planning of airports with consideration for the future needs of aeronautics, when flying operations probably will include scheduled operations between centers of population and between large cities and small outlying communities, as well as activities of private owners commuting daily to their offices from points as far as 100 miles away, is urged in Aeronautics Bulletin No. 2, Airport Design and Construction, just published by the Aeronautics Branch, Department of Commerce. The bulletin is now available for distribution and may be obtained without charge upon request to the Aeronautics Branch in Washington.

The detailed subjects discussed in the bulletin include: Problems of municipalities, airport planning in relation to city planning; selection of an airport site; constructing an airport; airport lighting and seaplane airports.

With regard to airport problems in general, the bulletin says:

In nearly all instances, the large city is faced with the necessity of providing one or more terminal airports so located that they will efficiently serve its widespread population. Operations from these terminal airports will eventually be continued in the main to scheduled air transport and large scale taxi service. In addition to the terminal airports there will be specialized airports furnishing roundhouse facilities and serving as ports from which such activities as sales, service, school, aerial, photography, and crop dusting can be carried on.

In the very large cities during the next few years, it is believed that suburban air travel will grow to a marked extent. This traffic will undoubtedly be of two classes: First, scheduled operations between the large city and small outlying communities; and second, activities of private owners who will commute daily to their offices by air from their estates within distances up to possibly 100 miles.

Airport Lighting—Airport lighting equipment is covered in a new publication, Catalog 218-FA, announced by the Westinghouse Electric and Manufacturing Company, Edgewater Park, Cleveland, Ohio. Photographs and drawings supplement the text in describing the construction and application of the equipment. This catalog includes not only such equipment as floodlights, beacons, searchlights, obstruction lights, wind indicators, and marker lights, but auxiliary apparatus such as electric service plants, current regulators, transformers, switches, relays, cable, and panelboards.

A feature of this booklet is a two-page drawing illustrating an airport and showing the various kinds of lighting equipment it should have.

***Copies of the above publications may be obtained without charge by writing* PUBLIC WORKS.**